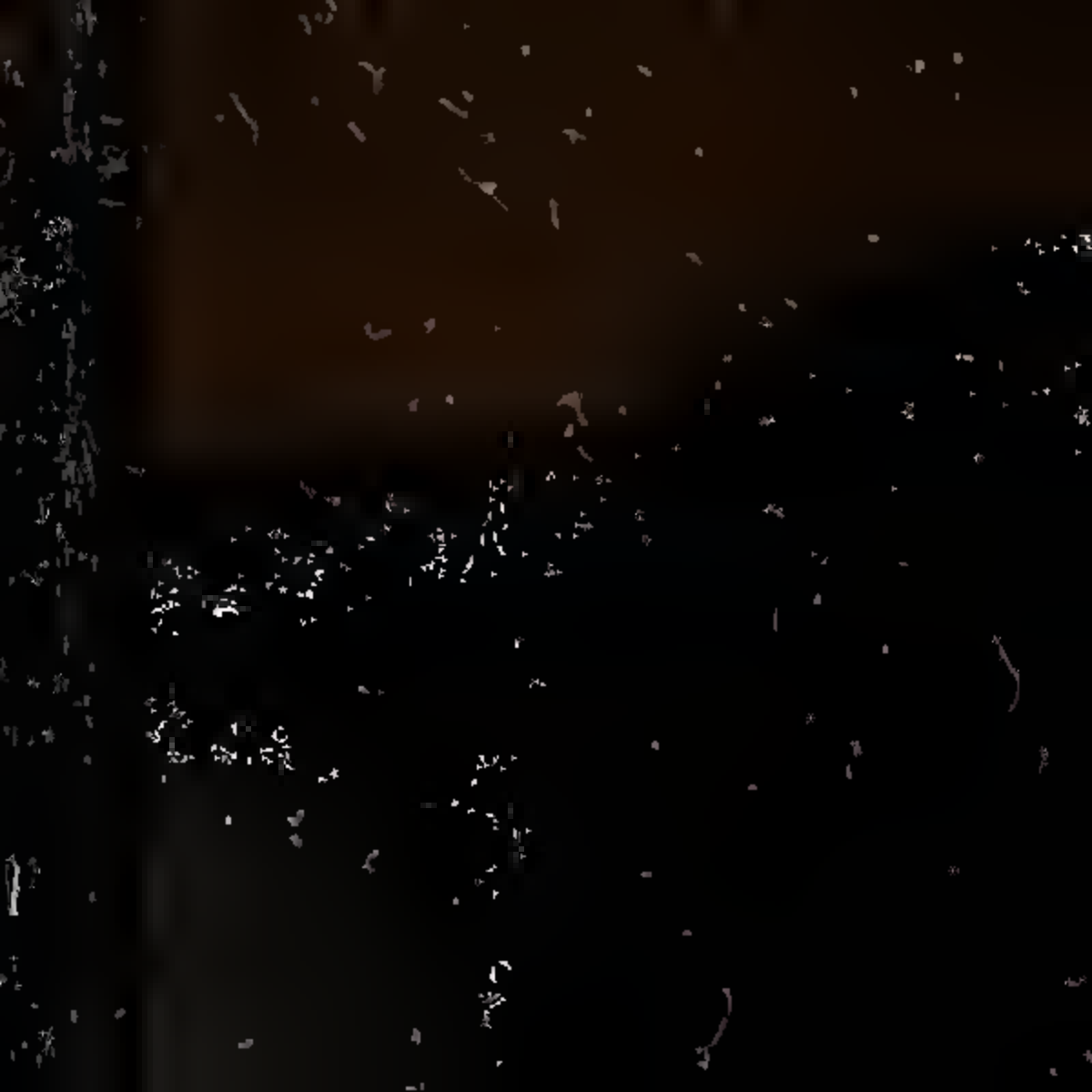

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The following pages contain a brief description of a course of Dissections, which the Author has found practically useful in teaching Anatomy.

The Author has thus been led to describe separate Dissections, 1st, of the Muscles, Fasciæ, and Abdominal and Thoracic Viscera; 2dly, of the Ligaments; 3dly, of the Brain and Nerves; 4thly, of the Blood-vessels; adding, finally, some account of the Absorbent Vessels, and of the contents of the Female Pelvis.

The terms employed to denote the relative position of parts, as, for instance, upper and under, anterior and posterior, apply to the body when erect and facing the observer with the palms of the hands and the toes directed forwards. The terms inner and outer, have reference to the imaginary median plane, by which the body is supposed to be divided into two symmetrical portions.

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A COURSE OF

DISSECTIONS.

CHAPTER I.

OF THE MUSCLES AND VISCERA.

§ 1. DISSECTION OF THE ABDOMINAL MUSCLES.

IN order to give tension to the abdominal muscles, place two blocks below the loins of the subject: make an incision through the integuments, from the ensiform cartilage to the symphysis of the pubes, inclining the knife at the centre of this line so as to avoid the umbilicus. Make a second incision from the ensiform cartilage through the integuments covering the ribs, not transversely, but obliquely towards the loins. On raising the flap of skin at the meeting of these incisions, you observe adipose texture below it, which, when plentiful, destroys the membranous appearance of the cellular texture. The latter, in lean subjects, may be dissected off as a layer of fascia. It is thicker and more distinct towards the groin, and is called *fascia superficialis abdominis*.

Some nicety is required at the commencement of this dissection, in exposing the thin aponeurosis, which covers the upper part of the rectus, and is attached to the ensiform cartilage and to the cartilages of

the lower true ribs. Below this part, the tendinous surface is coarser and not likely to be inadvertently cut through, except at points where vessels and nerves are transmitted, or at its external edge where it dovetails with the muscular fibre. The process of muscular dissection consists in straining the cellular substance, which adheres to the flesh and tendon, and dividing it by long incisions upon and parallel to each fasciculus. In this manner you may denude the broad tendinous and fleshy surface of the outermost of three flat muscles, which extend each from the spine to the front of the abdomen.

The outermost of these three muscles is called the obliquus externus, or descendens abdominis; the next, the obliquus internus, or ascendens; the third and innermost, the transversus. Their flat tendons coalesce anteriorly in the median plane of the body; by which means, an opake white line is formed, extending from the ensiform cartilage to the symphysis of the pubes. At from three to four inches distance on either side of this white line, the same three tendons are again in contact and cohere together, describing an opake gibbous line, the horns of which approach the ensiform cartilage and the crest of the os pubis. Remark likewise, that the edge of the tendon of the obliquus externus, between the superior anterior spinous process of the ilium and the crest of the os pubis, is abrupt, tense, and thick. It is convenient to consider these five lines, as so many distinct ligaments giving attachment to muscles. *That* in the centre is termed the *linea alba;* the curved line on either side, the *linea semilunaris;* the third is termed *Poupart's ligament.* Notice that the greater part of the

muscular and tendinous fibres of the obliquus externus slant obliquely downwards and forwards; but that the posterior muscular fasciculi descend from the last rib to the crest of the ilium nearly vertically, and parallel to those of the latissimus dorsi, with which they are in contact. Notice the outer layer of cross tendinous fibres; the breadth of the tendon below, which slopes with a concave margin to the crest of the ilium; its termination above in a tendinous expansion or aponeurosis covering the rectus; its three or four or five transverse white lines, the greater number above the umbilicus, marking the intersections of the rectus; and finally, its triangular aperture above the crest of the os pubis, called the external ring, which transmits the spermatic chord.

1. *Origin* of the Obliquus Externus. From the inferior margins of the eight lower ribs by eight fleshy slips, of which the five upper are attached below the origins of the serratus magnus, and the three lower below the costal attachments of the latissimus dorsi.

Insertion. Into the ensiform cartilage, the linea alba, the crest of the os pubis, the ligament of Poupart, and the external margin of rather more than half the crest of the ilium.

Use. To diminish the depth and breadth of the abdomen; to depress the ribs; to incline the body forward and to the same side; and to rotate it towards the opposite.

Separate the obliquus externus at its origin from the ribs; at its insertion from the crest of the ilium, and dissect the second layer of muscular fibres, which are remarkable for their contrary inclination to those

of the obliquus externus, and terminate in a flat tendon at the linea semilunaris.

2. *Origin* of the OBLIQUUS INTERNUS. From the spinous processes of the lumbar vertebræ, sacrum and os coccygis, and from the margin of the tuberosity of the ilium, by a tendinous expansion, called the *fascia lumborum*. From the outer margin of the crest of the ilium, and from the outer half of Poupart's ligament by muscular fibre. At the linea semilunaris, the tendon splits into two layers, the anterior of which passes in adhesion to the tendon of the obliquus externus before the rectus; the posterior behind the rectus, and in cohesion with the tendon of the transversus.

Insertion. By the anterior tendon, which contributes also to form the aponeurosis of the rectus, into the ensiform cartilage, the linea alba, and crest of the os pubis: by the posterior tendon, into the ensiform cartilage, and into the upper four fifths of the linea alba, below which the posterior tendon is deficient.

Use. Like the preceding, except that it rotates the trunk towards the same side.

The lower fibres of the obliquus internus are directed transversely; the lowermost are slender and inclined downwards and forwards, and detach a considerable fasciculus called the CREMASTER muscle, which encloses the spermatic chord, and is finally spread out on the testis.

Divide the obliquus internus by a vertical incision extending from the ribs to the middle of the crest of the ilium, and dissect either portion from the next layer of muscular fibres, which are disposed transversely, and form a tendon at their lower part earlier, at their upper part, later than the obliquus internus.

3. *Origin* of the TRANSVERSUS ABDOMINIS. From the inner surfaces of the cartilages of the seven lower ribs, where its fleshy fibres coalesce with those of the diaphragm: tendinous from the transverse processes of the four upper lumbar vertebræ; from the inner edge of the crest of the ilium, and from the outer half of Poupart's ligament.

Insertion. The same with that of the posterior tendon of the obliquus internus: so that, strictly speaking, the lowermost fibres of the transversus, which are slender and inclined downwards and forwards, are inserted into the linea semilunaris.

Use. To diminish the depth and breadth of the abdomen, and to depress the ribs.

On cutting through the lower part of the transversus, you observe a layer of fascia interposed between it and the peritoneum, which is called *fascia transversalis.*

Make a vertical incision at a little distance from and parallel to the linea alba through the cohering tendons of the obliquus externus and obliquus internus, so as to expose the rectus and pyramidalis muscles, which are contained between the two layers of the tendon of the obliquus internus. The pyramidalis is a small triangular muscle, placed before the lower part of the rectus, and sometimes deficient.

4. *Origin* of the PYRAMIDALIS. Fleshy from the margin of the crest of the os pubis.

Insertion. Into the lower fifth of the linea alba.

Use. To depress the ensiform cartilage by shortening the linea alba.

Origin of the RECTUS. Tendinous and fleshy from the crest of the os pubis: it soon attains its breadth of from three to four inches; its fibres then ascend parallel to the linea alba, and are remarkable for three, four, or five transverse bands of tendon, which are nearly complete intersections at the fore part, but do not interfere with many of the posterior fasciculi.

Insertion. Into the ensiform cartilage, and in succession outwards to the cartilages of the seventh, sixth, and fifth ribs.

Use. To depress the ensiform cartilage and the ribs: to incline the trunk forwards: to diminish the depth of the abdomen. The tendinous intersections increase the number of muscular fibres, and perhaps facilitate their partial contraction.

The abdominal muscles are employed in swaying the trunk forward and laterally, and in rotating the spine. They contribute to expiration by depressing the ribs and sternum and by raising the diaphragm; or combining their action with that of the diaphragm, they assist in expelling the contents of the abdominal and pelvic viscera; as in labour, vomiting, the passage of urine and fæces. Lastly, their habitual pressure supports the venous system of the abdomen.

It frequently happens, that either from too great an exertion of the abdominal muscles in a vigorous frame, or during their slight exertion in one of a relaxed character, a portion of an abdominal viscus is thrust out in a sac of peritoneum, at one or other of those parts of the abdominal parietes, which offer naturally the least resistance: such a protrusion constitutes an hernia, and may be forced out at any point of the abdominal parietes, besides certain specific pas-

sages immediately to be noticed; in the former case the tumour is termed a ventral hernia. The specific hernial passages are, first, the umbilicus; secondly, the spermatic passage; and thirdly, the crural arch.

The *umbilicus* is a cicatrix of the surface, at which the remains of the umbilical chord were separated by ulceration. It is placed in the centre of the linea alba, and is opposite to the fourth lumbar vertebra. When an umbilical hernia is to be reduced by the taxis, it is obvious that the body should be bent forward, in order to relax the linea alba, through which the protrusion has taken place. When an operation is performed for umbilical hernia, the division of the stricture should either be directed upward or downward; a division laterally would, in theory, tend to weaken the linea alba, and might possibly involve a branch of the epigastric artery.

The *spermatic passage* transmits through the lower part of the abdominal parietes a substance termed the spermatic chord, which is continuous with the testis, and consists of the vas deferens or excretory duct of the testis, of the spermatic artery, veins, absorbents, and nerves, enclosed within a common sheath of cellular membrane and the cremaster muscle. The spermatic passage is oblique, and extends along somewhat more than the inner half of Poupart's ligament, which may be said to form its floor: the chord, however, has a greater inclination upwards than the ligament of Poupart. The anterior wall of the spermatic passage is the tendon of the obliquus externus; the posterior, the fascia transversalis: its roof consists of the unattached edges of the obliquus internus and transversus, the lowest fibres of which, at their origin

from Poupart's ligament, are for a short space anterior to the chord. The anterior outlet of this passage must be an opening in its anterior wall; this opening is termed the *external ring*, is in shape triangular, and seems formed by the divergence of the tendinous fibres of the obliquus externus; its outer and inner margins are termed *pillars*; the inner pillar being the last tendinous fasciculus inserted into the crest of the os pubis; as the outer is the first inserted into the ligament of Poupart.

From the edges of the external ring a fascia in part, it would seem, continuous with the slighter cross fibres of the tendon of the obliquus externus, is extended to the chord, of which it forms another tunic.

The *inner ring* again is the name given to the opening in the posterior wall of the spermatic passage or fascia transversalis; and, as in the former case, a cellular tunic is derived from the edges of this ring to the chord. The internal ring under ordinary circumstances has no defined margin; but slight pressure with the handle of a scalpel renders a circular margin distinct below and on either side, to either edge of which the term *pillar* is again applied; in the fascial substance, which forms the inner pillar of the internal ring, the epigastric artery and vein ascend obliquely towards the umbilicus: the artery lies external, or nearest to the margin of the ring.

An hernia descending obliquely along the spermatic passage is termed inguinal; and specifically, a bubonocele, if it has not escaped through the external ring. An hernia protruding directly through the external ring is termed ventro-inguinal. In either case, if reduction by the taxis is attempted, the trunk is to be bent by

raising the chest and hips, so as to relax the tendinous and muscular parietes of the abdomen. When an operation is performed, the incision through the neck of the sac in the first case is to be directed upward and outward, in the second upward and inward, so as to avoid the epigastric vessels laterally and the chord below.

The chord is generally found below and behind an inguinal hernia; but sometimes its elements are spread out upon the hernial sac.

The anatomy of crural hernia may now be examined. Let the abdominal muscles be removed, leaving the linea alba, the ligament of Poupart, and the fascia transversalis. You may observe, that the inner extremity of Poupart's ligament is of considerable depth, or that it sends backward a process of an inch in breadth to the sharp margin, at which the lesser and greater cavities of the pelvis meet, called the linea ilio-pectinea; this process has externally an unattached falciform edge, and is termed *Gimbernat's ligament*. You may further notice, that the fascia transversalis does not terminate abruptly at the ligament of Poupart; but, having lined this ligament and its process, is prolonged under another name, as *fascia iliaca*, over those muscles, which occupy the fossa of the ilium: upon the inner edge of one of these, namely the psoas magnus, are situated the external iliac artery and vein, the latter internally. Both vessels are tied down to the edge of the psoas magnus by the fascia iliaca, which splits to form their sheath, and encloses them till they pass below Poupart's ligament upon the thigh: adipose substance, lymphatic vessels, and glands are interposed

between these vessels and the falciform edge of Gimbernat's ligament; it is here, that crural or femoral hernia makes its exit, having before the neck of its sac Poupart's ligament, internally to it the ligament of Gimbernat, immediately behind it the body of the os pubis with the pectineus muscle, and more outward, that is to say externally and behind it, the external iliac vein and artery upon the psoas magnus.

To complete the anatomy of crural hernia, it is requisite to dissect the fasciæ at the fore and upper part of the thigh, so as to expose the under surface of the ligament of Gimbernat: for this purpose, dissect off the skin of the fore part of the thigh for four inches down, beginning at Poupart's ligament: the cellular layer below it, containing fat and inguinal lymphatic glands, is of some thickness; it is termed the *fascia superficialis femoris*. You are to notice, internally, one or two subcutaneous veins, the larger of which is called the vena saphena major, ascending in this fascia in a direction towards the middle of Poupart's ligament, an inch below which they dip into the cellular and fatty substance, and disappear; divide these veins at the lowest part of the denuded surface, and raise the layer of fascia, in which they appear to lie. You will find within this another fascia of a more compact texture closely investing the muscles of the thigh, and called the *fascia lata femoris*. On attempting to expose fully the fascia lata, by raising entirely the fascia superficialis, you will find the latter retained at one part by the vessels, which plunge from it to join the deep-seated vessels of the thigh. The outer and fore part of the fascia lata appears to ascend directly towards and to cohere with the superior anterior spinous process of the ilium

and the outer two thirds of the ligament of Poupart; but with the inner third by means of a falciform process, the circular edge of which contributes to form the *crural arch*. On following the opposite continuation of this sharp incurvated margin, it is observed, first, to slope downwards, then inwards, and finally to ascend obliquely inwards. This sharp margin is lost upon the pectineus muscle, upon which the fascia lata finally ascends to the ligament of Gimbernat, to be reflected over its under surface. At first there would seem to be an abrupt oval aperture, of an inch in height, left at this part between the two planes of the fascia lata: on a more attentive observation you will, however, notice, that the curvilinear edge marks only a reflection of the fascia lata, which here for a short extent passes outwards, then is again carried inwards and spread out at a deeper level and in thinner substance upon the femoral portion of the psoas magnus and iliacus internus; whence extending inwards it splits to form a sheath for the artery and vein, and afterwards passes on as one continuous surface with the fascial investment of the pectineus. Thus the fascia lata lines the under surface of the ligament of Gimbernat, is reflected outwards from its falciform edge, and forms the sheath of the femoral artery and vein, exactly in the same manner as the fascia iliaca encloses the iliac vessels: strictly speaking, these two fasciæ come into close adhesion, and form one layer at the falciform edge of the ligament of Gimbernat; a layer of great firmness, which tends materially to support the aperture of the crural arch against the pressure of the bowels, being the same substance which has been described as fascia cribriformis; or under the name of fascia infundibuliformis, from the conical pit it repre-

sents above, when a little force has been used to extend it.

Previously to the reduction of a crural hernia by the taxis, the hip-joint is to be bent, the shoulders and pelvis raised, and the thigh turned inwards. In dividing the neck of the sac, should an operation prove necessary, an incision of three lines may be made upwards through Poupart's ligament, or upwards and inwards through the falciform edge of Gimbernat's ligament, where it leaves the former.

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§ II. OF THE VISCERA OF THE ABDOMEN.

Remove the abdominal muscles and fascia transversalis, leaving the linea alba entire: the viscera of the abdomen are seen through the thin *peritoneum*, the cellular surface of which adheres firmly above and anteriorly, loosely below and externally, to the parietes of the abdomen. Make a longitudinal incision through the peritoneum, on either side of, and parallel to, and at the distance of two inches from the linea alba; then divide the peritoneum and linea alba transversely at the umbilicus, and turn back the separate portions. You notice the inner lubricated surface of the serous membrane, and its general reflection over the bowels, the movements of which it facilitates and confines within certain limits, as it supports and conveys their nerves and vessels, and isolates each viscus from the rest.

The viscera are seen through their covering of peritoneum; they thus may be said to lie behind the

peritoneum. At the upper part of the abdomen is seen the liver, great part contained in the hypochondria, but occupying centrally the epigastrium for three inches below the ensiform cartilage. Below the liver the stomach is seen extending obliquely downwards from left to right: from its lower edge a loose quadruple fold of peritoneum called the omentum majus, descends, which differs in length and thickness in different subjects. The arch of the colon is seen through the root of the omentum lying transversely folded across the abdomen in the umbilical region: part of the caput coli appears at the right groin, and the rest of the abdomen seems occupied by the convolutions of the small intestines.

The upper surface of the *liver* is convex, the under concave or flattened, with numerous depressions or fissures; the anterior margin acute, and sloped away, so as on the right side to match the margin of the chest; it has a central notch; the posterior margin is obtuse, and attached by the peritoneum to the diaphragm, as the broad thin muscle is called, which forms the concave roof of the abdomen. If you now raise the central slip of peritoneum attached to the upper half of the linea alba, a ligament consisting of two layers of peritoneum is seen to extend from the linea alba and diaphragm to the upper surface of the liver in the median plane of the body; this is termed the *ligamentum latum;* its unattached edge contains a tough cellular chord, which, in the fœtal state, was the umbilical vein; in its present state, thickening the edge of the broad ligament, it forms the *ligamentum teres*, which is seen at the anterior margin of the liver to be con-

tinued in a fissure along its under surface, as the broad ligament is attached along its upper.

If the hand be passed over the upper surface of the liver, when it reaches the posterior margin of the liver, it is abruptly stopped by the transverse reflexion of the peritoneum from the diaphragm: the reflexion is here immediate, it has no depth; it is termed the *ligamentum coronarium:* laterally the reflexion forms a ligament of some extent; its two laminæ of peritoneum are in contact upwards of an inch, before they reach the edge of the liver from the diaphragm: this part of the transverse reflexion of the peritoneum is termed the *ligamentum laterale* of either side.

The liver is described as having two lobes, one on either side of the median plane; a greater *right*, a smaller *left lobe.* The under surface of the left lobe is tolerably uniform, that of the right subdivided by fissures into lobules. Raise the anterior margin of the liver, and draw down the stomach; a ligament is seen to descend from the former viscus to the latter, having on the right side a thickened unattached edge, called the *capsule of Glisson:* the ligament itself may be considered as formed of two laminæ of peritoneum, one derived from the fore part, the other from the back part of the liver; which, having come in contact at a transverse line upon its under surface, are extended from thence to the upper concave edge, or lesser curvature of the stomach; they thus form the *lesser omentum.* Divide this ligament, leaving the capsule of Glisson. You may now, on completely raising the liver, observe that a groove extends along

the whole of its under surface in the median plane, beginning at the notch in its anterior margin; that from the middle of this groove another extends transversely outwards along the under surface of the right lobe for the space of three inches nearly; the last is termed the *transverse fissure*. The capsule of Glisson appears attached to the liver at the right extremity of the transverse fissure.

Of the two portions of the central groove, that before the transverse fissure is called the *fissure for the umbilical vein*, that behind it, the *fissure for the ductus venosus*. A cellular chord seems to extend the whole length of the median groove, which was pervious in the fœtal state, and reached the vena cava inferior under the names just mentioned. Parallel to the fissure for the umbilical vein, the *fissure for the gall bladder* is seen. The obtuse end of the gall bladder frequently, when distended, projects beyond the margin of the liver. The elevated surface, bounded within by the fissure for the umbilical vein, without by the fissure for the gall bladder, behind by the transverse fissure, and before by the anterior margin of the liver, is the *lobulus quadratus*. Behind, but much in a line with the fissure for the gall bladder, is the *fissure for the vena cava*, which, with the transverse fissure, and the fissure for the ductus venosus, and the posterior margin of the liver, circumscribes the *lobulus Spigelii*. A narrow prominent surface, extending transversely towards the right from the anterior inferior and right corner of the lobulus Spigelii, or the surface between the fissure for the vena cava and that for the gall bladder, is termed the *lobulus caudatus*.

The liver is brittle, in structure granular, each

separate particle being a complete gland, supplied with branches of the hepatic artery, of the vena portæ, of the venæ cavæ hepaticæ, of the hepatic nerves and absorbents, and of the hepatic duct. Its external tunic is peritoneal, within which is found, as in other conglomerate glands, a cellular tunic, connecting together the parts of the gland on the surface, and throughout its substance.

The three or four great veins termed *venæ cavæ hepaticæ*, which return the blood from the liver, after emerging from its posterior margin on either side of the median plane, directly enter the vena cava ascendens. Several absorbent trunks ascend between the layers of the five ligaments, and perforate the diaphragm: but the place, at which the greater number of vessels and nerves enter or leave the liver, is the transverse fissure, where the capsule of Glisson, which contains them, is affixed. On dissecting off the anterior layer of peritoneum from the capsule of Glisson you observe, surrounded by a plexus of absorbents and of nerves, *on the right* a yellowish green tube, *the ductus communis choledochus*, which traced upwards divides into the *ductus cysticus* a tube communicating with the gall bladder, or which, becoming tortuous and dilated, finally expands into the gall bladder; and, secondly, the *ductus hepaticus*, which subdivides into two tubes, one of which passes to either lobe of the liver. The ductus communis choledochus, traced downwards, perforates obliquely the posterior surface of the duodenum at the distance of three inches from the pylorus. *On the left*, you observe the hepatic artery branching into the right and left hepatic; and below and between the duct and the artery, a great vein called the *vena portæ* is seen, which is formed by the

union of the ventricular, splenic, pancreatic and mesenteric veins, and is distributed in the liver like an artery. The bile is supposed to be secreted from the venous blood of the capillary extremities of the vena portæ.

The passage behind the capsule of Glisson is called the *foramen of Winslow.*

A special aperture in the diaphragm transmits the *œsophagus*, which emerging into the belly on the left of the median plane, and opposite to the tenth dorsal vertebra, opens into a curved conical sac, *the stomach*, at what is called its *cardia* or *cardiac orifice.* The upper concave margin of the stomach, to which the lesser omentum is attached, is called its *lesser curvature;* the opposite more extensive and convex margin, *the greater curvature;* the dilatation to the left of the cardia is called the *fundus* of the stomach; it is lodged in the left hypochondrium, and the peritoneum is reflected from it to the spleen.

The *spleen* is an oval parenchymatous viscus, coloured by the blood it contains, about five inches in its long diameter, which is vertical; convex externally, where it rests against the diaphragm, having a longitudinal fissure internally, where its vessels and nerves enter, having no duct, but numerous small cells in its brittle and vascular substance. The two laminæ of peritoneum reflected from the stomach to this viscus contain the vasa brevia, which are five branches derived from the splenic artery to the stomach. The two laminæ, which pass from the internal surface of the spleen to the diaphragm, constitute the ligament of the spleen.

At its right extremity, the *stomach* is narrower, and ascends behind the right lobe of the liver. When not distended, a small portion only of the stomach is ex-

posed below the liver in the lower part of the epigastrium. A distinct circular contraction, where its substance may be felt to be of unusual thickness, marks the inferior or *pyloric orifice* or *pylorus* of the stomach: its place is to the right of and anterior to the spine, and at the level of the twelfth dorsal vertebra. Here the *small intestine* begins, a tube about four times the length of the body, apparently cylindrical when distended, but really conical; its diameter is greatest near the stomach.

The portion of the small intestine, which begins at the pylorus, is called the *duodenum* from its length of about twelve inches; its disposition is almost circular; the duodenum first passes to the right underneath the liver, is then inclined downward before the right kidney as low as to the third lumbar vertebra, and finally reascends, crossing the spine obliquely from right to left, and ending upon the left side of the second lumbar vertebra.

The *pancreas* is an oblong gland, of a pale yellow colour, composed of particles of from an eighth to a third of an inch in diameter: its entire length is about six inches, its breadth an inch and an half; and more than this at its right extremity or head, which is encircled by the curvature of the duodenum, and is placed on the right of the spine; from thence the body of the gland crosses the spine obliquely, and terminates to the left of the first lumbar vertebra. The pancreas has two ducts; one, the larger, derived from the body of the gland leaves it at its head, and perforates the duodenum obliquely along with the ductus communis choledochus; the other, smaller, and derived from the head of the gland, perforates the duodenum at half an inch distance from the first.

The first inch and an half of the duodenum is entirely surrounded with peritoneum; the rest has the anterior two thirds alone of its cylinder invested by this membrane: thus the duodenum is closely tied down to the back.

As soon as the small intestine rises from the spine, being now entirely surrounded by peritoneum and moveable in the abdominal cavity owing to the depth of its peritoneal ligament or *mesentery*, the tube is termed the *jejunum;* a name, which applies to the upper two fifths of what remains of the small intestine, as the name *ileum* is given to the lower three fifths. If you turn the mass of convolutions from side to side, you observe, that however ample the margin of the mesentery may be, at which it joins the intestine, yet that at its root its length does not exceed six inches. You will observe, that the mesentery at its origin seems half surrounded by the last curve of the duodenum, that it extends from the left side of the second lumbar vertebra obliquely towards the right groin, terminating above the linea ilio-pectinea and psoas magnus, half way between the spine and the middle of Poupart's ligament: that its depth from the spine to the bowel is about five inches; that it contains arteries, veins, nerves, and absorbents tending to or derived from the bowel, and absorbent glands.

The ileum is connected with the *great intestine*, much in the same way as the œsophagus with the stomach, in outward appearance at least. The ileum seems to open into a more spacious cylindrical cavity, which is continued to the right as the *colon*, but terminates on the left in a cul-de-sac, called *intestinum cæcum* or *caput coli:* the cæcum varies in length, from two to five

inches; it has at its extremity a fine tube, a third of an inch in diameter, extending inwards, curved upon itself, attached by a sort of mesentery to the side of the pelvis, and called the *appendix cæci vermiformis*.

The first five feet of the great intestine belong to the colon; of which you notice, first, the *caput coli* just described, as the portion to the left of the entrance of the ileum; and to the right, the *ascending portion*, which mounts before the right kidney, as high as the second lumbar vertebra; though closely tied down, it is not so completely surrounded with peritoneum, but that for nearly its whole extent, a narrow line on the posterior surface of the bowel is in contact with the fascial covering of the muscles. The extent, to which the ascending portion of the colon is thus left denuded, varies in different bodies; always near the liver, the bowel is quite encircled by peritoneum, the layers of which meet, so as to form a short ligament analogous to the mesentery, which is termed the *mesocolon*. You now trace the intestine traversing the abdomen from right to left; this part is termed the *transverse portion* or *arch of the colon;* it is of such length compared with the breadth of the abdomen, as to lie partly folded. The mesocolon of the arch is eight inches in depth centrally, and seems, when the colon is drawn out, to divide the abdominal cavity into an upper and an under chamber: *in the first* are found the upper part of the kidneys, and of the duodenum, the pancreas, and renal capsules, behind the layer of peritoneum, which passes down to be the uppermost in the mesocolon; as well as the stomach and spleen: *in the second* of these chambers is seen the lower part of the kid-

neys and of the duodenum, through the layer of peritoneum, which ascends to form the inferior lamina of the mesocolon; as well as the jejunum and ileum.

You may now examine the nature of the *omentum majus*, which seems attached equally to the stomach and arch of the colon: its composition may be thus explained: suppose the two layers of peritoneum, which have clothed the anterior and posterior surfaces of the stomach, to meet at its great curvature, to pass off from thence for a depth of from five to ten inches from the stomach; then taking no attachment, to be reflected upward, and finally to reach the colon: subsequently to separate and enclose its arch, and finally to reunite to form the mesocolon. The omentum majus would on this supposition be composed of four layers of peritoneum; and that it is so is readily displayed in very young subjects, in which the handle of a scalpel insinuated behind the capsule of Glisson the lesser omentum and the stomach, and gently pressed downward before the colon, separates readily the adhesion of the reflected serous surfaces of the omentum, exhibiting on either side a distinct peritoneal ligament of two layers.

The colon having arrived at the left side, descends under the name of the *descending portion*, having a mesocolon, distinct, but not exceeding two inches in depth. The bowel is inclined over the margin of the psoas magnus into the pelvis, and being of some length and convoluted is called at this part the *sigmoïd flexure* of the colon. The last part of the great intestine is called the rectum, which descends along the curvature of the sacrum to the anus. The *rectum*, when extended, is about ten inches in length; above, it is surrounded by peritoneum, from which it derives a ligament called the

mesorectum: the lower part of the rectum, for four inches before and nearly six behind, has no peritoneal covering.

The great intestine is characterized, first, by its capaciousness, being at its commencement frequently four inches in diameter, when distended: from thence onward it is narrowed, but at the rectum is again somewhat dilated: secondly, by its sacculated appearance: thirdly, by three longitudinal bands, which begin at the root of the appendix cæci vermiformis, and extend to the rectum, where two coalesce; the two, which thus remain, finally expand, and form a cylinder of longitudinal fibres; one of the longitudinal bands of the colon is concealed by the attachment of the omentum, and another, in some measure, by the attachment of the mesocolon: fourthly, by little sacculi of peritoneum, which in fat bodies contain adipose substance, are generally numerous, and adhere to the anterior surface of the bowel, being termed *appendices epiploïcæ.*

To obtain a notion of the structure of the alimentary canal, draw down a portion of the œsophagus, divide and tye it, and then remove the whole length of the stomach and bowels, wash and invert the entire stomach, with a short portion on either side of the œsophagus and duodenum: invert separate portions of the jejunum, of the colon, and of the rectum. You will observe the inner mucous surface to be distinctly villous in the stomach and small intestines, less so in the great intestine, and still less distinctly villous in the œsophagus, where in some cases it seems clearly to have a cuticular lining. With care, you may dissect off this villous surface in each portion, as a distinct, highly vascular, and delicate membrane, the *tunica villosa.*

The tunic thus exposed, and easily separable from a third, is thick and of great strength, resembling a fascia in appearance: it is called the *tunica nervea*. The tunica villosa and tunica nervea form an organ strictly analogous to the true skin; the latter corresponding to the tough substratum of the skin, the former to its vascular and papillated surface.

These inner tunics not being irritable, nor having the elasticity of those without, are thrown into folds of different kinds, unless the alimentary canal be distended. In the ordinary state of the œsophagus, the villous and serous coats are thrown into longitudinal plaits or *plicæ:* in the stomach into *rugæ*, intercepting irregular areolæ: in the small intestines, into numerous very regular transverse plaits, each extending three quarters round the cylinder, and termed *valvulæ conniventes*. In the great intestines slight *rugæ* are again perceptible, especially in the rectum.

In healthy viscera it is difficult to detect a glandular structure. Where much irritation has existed in the small or great intestines, little nodules are found, which seem to be thickenings of the parietes of small sacs, which may be organs of secretion.

The third tunic is *muscular*. From the upper part of the œsophagus to the anus the alimentary canal is surrounded by circular fibres, in the order of which, however, there are two interruptions; the circular fibres of the œsophagus terminate at the cardia, or form only a slight irregular layer soon lost upon the adjoining surface of the stomach. The series of circular fibres belonging to the stomach and small intestines begins at the centre of the fundus of the stomach; this series is continued to the termination of the ileum, where the

second interruption occurs, as the circular fibres of the great intestine are disposed around the axis of the cœcum.

Circular fibres are most numerous at the extreme parts of the canal, around the œsophagus and the rectum, and act in each case as sphincter muscles: when the stomach is distended, the action of the circular fibres of the œsophagus prevents the return of its contents towards the fauces: the last circular fibres of the rectum act in a corresponding manner, and are called the *sphincter internus ani.*

But *longitudinal* fibres are met with on the alimentary canal: these are always external to the circular fibres above described, and are only well developed at the two extremities of the whole tube. The œsophagus has a very thick external tunic of longitudinal muscular fibres, which reaching the stomach are expanded in one series along the minor curvature, in another along the greater: they are both insensibly lost towards the pylorus.

No longitudinal fibres are generally distinguishable on the small intestines: in some cases, perhaps, they are faintly traced on the unattached margin: but they reappear upon the colon. The three longitudinal bands of the colon consist of muscular fibres, on the tonic contraction of which the sacculation of the great intestines entirely depends; and, finally, the rectum at its lower part is invested, like the œsophagus, with a complete cylinder of longitudinal fibres. In the eversion of the bowel termed prolapsus ani, the villous, nervous, and muscular coats are equally involved.

There is no valve at the cardia: the *valve of the pylorus* is a thickening of the nervous and muscular

coats of the bowel. The *valvula coli* is formed by the projection of the three proper coats of the ileum into the cavity of the colon, in the shape of two transverse semilunar lips.

The extent, to which the peritoneum covers the alimentary canal, has been already mentioned: it is needless to describe cellular coats in the intervals of and connecting the preceding tunics.

The removal of the viscera already examined shows the kidney, ureter, and renal capsule on either side of the spine.

The *kidney* is covered by peritoneum anteriorly only; its length is from four to five inches, its breadth about two; its external margin convex; its internal margin concave: it is broader and thicker above than below, and somewhat more convex before than behind. The renal artery and vein (the latter, before and above the former) attach it to the spine. A conical sac, the *pelvis of the kidney*, descends obliquely from the centre of the hollow margin behind these vessels; it is three quarters of an inch in depth, and terminates in a cylindrical tube, called the *ureter*, which descends parallel to the spine upon the psoas magnus, sloping finally over its margin into the pelvis nearly opposite to the sacro-iliac joint. The kidneys are placed upon the diaphragm, quadrati lumborum, and psoæ magni, between the twelfth dorsal and fourth lumbar vertebræ; that of the left a little higher up than that of the right side.

In order to examine the structure of a kidney, make a section from the external nearly through to the internal margin: the outer, or *cortical substance*, appears to be granular and highly vascular; it is for the

most part one third of an inch in thickness; but its substance is continued forward to the concave margin of the kidney, so as to invest laterally about twelve to fifteen cones of firmer substance, which consist of exceedingly fine tubes: these tubes converge so as to point towards a common centre; their rounded terminations project about a quarter of an inch from the cortical substance at the central fossa of the kidney; they are sometimes joined in pairs, and they are termed *mammillary processes;* each is surrounded by a conical sac, into which the urine exsudes from innumerable orifices of the tubuli uriniferi upon the surface of each mammillary process: the conical sacs are termed *infundibula*, and open into two tubes which coalesce to form the pelvis of the kidney.

The *capsulæ renales* are small semilunar yellowish bodies, two inches in length, half an inch in thickness, in texture granular, having anteriorly a longitudinal furrow, within, a cavity containing a turbid serum; they are placed above and anterior to the upper margin of each kidney, with their concave edge downward.

The *testis* may be now examined: this gland is originally an abdominal viscus, but descends about the time of birth into the sac of contractile skin called the scrotum.

The *spermatic chord*, of which the course has been recently traced, is formed within the internal ring by the meeting of the spermatic artery, the two spermatic veins, a plexus of nerves and of absorbents, and of the vas deferens or excretory duct of the testis. The spermatic chord derives a fascial covering from the margin of the internal ring, a muscular tunic from the

obliquus internus, and a second outer fascial tunic from the pillars of the external ring.

The testis is a flattened oval body so suspended, that its axis points upwards and forwards; the spermatic chord seems to spread out so as to adhere to the whole length of its upper margin.

Pinch up with the forceps the loose tunic, which seems reflected over the body of the testis, and divide it. You have thus opened the cavity of a serous membrane; which, on the one hand, invests the flesh of the testis, on the other is reflected from its upper margin, so as to form a serous sac for its support. This serous sac was originally a part of the peritoneum, which was carried down during the descent of the testis, the communication being speedily after obliterated. The term *tunica albuginea* is commonly given to the portion of the serous membrane, which invests the testis, and the name *tunica vaginalis* to the reflected portion.

Another and more analogical appropriation of these terms consists in calling the entire serous surface *tunica vaginalis*, *propria* or *reflexa;* and in describing the proper coat of the testis within the latter as *tunica albuginea*.

A fold of parenchymatous substance, adhering to the upper margin of the testis, is seen to lap over the upper part and outside of the testis: this is called the *epididymis*.

On cutting into the substance of the testis, the gland appears subdivided by numerous membranous septa into many separate portions consisting of very delicate and convoluted tubes, which are the commencements of excretory ducts, and are called *tubuli testis:* these all adhere to the upper margin of the gland,

which is firmer than the neighbouring texture, and called the *corpus Highmorianum* or *rete testis;* the several excretory ducts coalesce and inosculate freely in their course upwards and forwards through this substance: they leave the body of the gland in the form of five or six convoluted tubes, called *vasa efferentia*, which finally unite in the epididymis. On dissecting off the serous covering from the epididymis, its substance appears formed of a convoluted tube; this is most distinct at its posterior part, where the tube is larger, being thence inflected upwards and forwards, and continuing tortuous, but less so than before: it is now termed the *vas deferens:* at length it becomes a straight tube; the white fibrous cylinder, of which it consists, is of great thickness, and readily separable from the other elements of the chord.

The artery, veins, absorbents, and nerves enter along the upper margin of the testis.

The appearance of the branches of the spermatic artery, previously to entering the gland, has obtained the name of *vasa pampiniformia*.

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§ III. OF THE MUSCLES EXPOSED ON REMOVING THE ABDOMINAL VISCERA.

The flat muscle, which occupies the fossa of the ilium, is the iliacus internus: the cylindrical muscle, which descends obliquely outwards from the lumbar vertebræ to join the preceding, is the psoas magnus: the slender tendon, often noticed upon the anterior surface of the psoas magnus, belongs to the psoas parvus: the oblong muscle interposed between the psoas magnus and the origin of the transversus, is the quadratus

lumborum. The muscle derived from the fore part of the lumbar vertebræ by two crura, which adhere to a central tendon, and subsequently prolonged by new fibres to the margin of the chest, thus forming the vaulted roof of the abdomen, is the diaphragm.

Origin of the ILIACUS INTERNUS. From the whole of the fossa of the ilium, from the transverse process of the lowest lumbar vertebra and the ligament extending thence to the crest of the ilium.

Insertion. Tendinous and fleshy into the posterior margin of the lesser trochanter, and the line leading downwards from it.

Use. To bend the hip joint; to rotate the thigh outwards, and to carry it inwards.

Origin of the PSOAS MAGNUS. By five fleshy lateral attachments from the bodies of the five lumbar vertebræ, and from that of the lowest dorsal; and by five other attachments, concealed behind the preceding, form the transverse processes of the five lumbar vertebræ.

Insertion. In common with the last muscle, which it joins above Poupart's ligament.

Use. The same as that of the iliacus internus.

Origin of the PSOAS PARVUS. From the bodies of the lowest dorsal and of the uppermost lumbar vertebræ.

Insertion. Into the linea ilio-pectinea and funnel-like fascia.

Use. To support the funnel-like fascia; and in some degree to sway the lumbar vertebræ forward, and to the same side. The first supposition is borne out by the fact that the psoas parvus is more frequently met with in women than in men; but in women, owing to the greater remoteness of the ossa ilii, there is a

wider space on either side behind the ligament of Poupart, and hence a greater liability to crural hernia than in men: whereas men, through the greater capacity of the spermatic passage, are rendered more liable to inguinal hernia.

Origin of the QUADRATUS LUMBORUM. From the posterior third of the crest of the ilium, and from the ligament connecting this surface with the lowest lumbar vertebra.

Insertion. Into the transverse processes of the four upper lumbar vertebræ, the body of the lowest dorsal vertebra, and the inner part of the lower margin of the twelfth rib.

Use. To incline the lumbar vertebræ to the same side, and to depress the lowest rib.

Origin and *insertion* of the DIAPHRAGM. The diaphragm rises from the lumbar vertebræ in two portions or crura, which constitute its *lesser muscle.* Either *crus* has four vertebral attachments: 1st, by a strong tendon to the fore part of the third lumbar vertebra: 2dly, by a thin muscular and tendinous slip to the body of the second lumbar vertebra: 3dly, by a similar slip to the body of the first lumbar vertebra: 4thly, by a like portion to the transverse process of the first lumbar vertebra. From these origins either crus ascends, and so spreads out its fasciculi, that the outermost reaches the lowest rib, and the innermost meets its fellow near the median plane. At this meeting, which occurs opposite to the lower margin of the eleventh dorsal vertebra, and rather to the left of the median plane, a decussation ensues; the inner fasciculus of the left crus generally crosses before that of the right, and the innermost of the right behind that of the left. The fasciculi, which have thus changed

places, ascend at half an inch distance, and meet again opposite to the tenth dorsal vertebra, having inclosed an oval aperture somewhat to the left of the median plane. The aorta, with the thoracic duct upon its right, is interposed between the crura of the diaphragm and the spine, and the œsophagus with the nervi vagi descends through the oval aperture.

The *centrum tendinosum* has somewhat of the form of a trefoil leaf: its apex is turned forwards; its base backwards; its breadth and depth are from five to six inches; its under surface is slightly concave; its disposition is rather oblique, being higher towards the right side than to the left, and is nearly on a level with the ninth dorsal vertebra: near its posterior edge, and upon the right of the median plane, an aperture nearly circular transmits the vena cava ascendens.

The centrum tendinosum receives at its base all but the outermost fibres of the crura, and gives rise before and laterally to the *greater muscle*, the central portion of which slopes downwards to the ensiform cartilage, and the two lateral portions to the inner margins of the cartilages of the seven lower ribs, diverging in the same ratio, as if they were direct continuations of the muscular fibres of the crura. The centrum tendinosum thus appears let in to the centre of the diaphragm, the external fibres of which have no distinction of greater or lesser muscle, but run directly from the uppermost lumbar vertebra to the last rib.

The term *ligamentum arcuatum* means a falciform tendinous edge, which occasionally forms a sharp border to the fasciculi last mentioned.

Use. To increase the height of the chest, and to diminish that of the abdomen.

§ IV. OF THE MUSCLES COVERING THE CHEST.

Make an incision through the integuments in a line from the ensiform cartilage towards the head of the humerus. This is nearly the direction of the muscular fibres of the pectoralis major, which occupies the whole surface of the pectoral region, and determines its outline.

Origin of the PECTORALIS MAJOR. By an upper, smaller, or *clavicular* portion, from the internal two thirds of the anterior margin of the clavicle; by a greater or *sternal* portion, which is separated from the preceding by cellular membrane, from the fore part of the sternum; from the cartilages of the fifth, sixth, and seventh ribs; and from the aponeurosis of the rectus. The upper fibres are inclined slightly downwards as well as outwards; the next, transversely; the lower and greater number ascend obliquely, so that the lowest fibres are situated, when near the insertion of the muscle, behind those, which near its origin are directly above them.

Insertion. By a flat tendon into the anterior or outer margin of the bicipital groove.

Use. By all its fibres to rotate the humerus inwards, and to carry it forwards and inwards: the lower and by far the greater portion carries the humerus downwards as well.

Cut the pectoralis major through transversely: by this means are exposed, below, a smaller muscle of a like form to the preceding called the pectoralis minor; and above, at an inch from the margin, a small cylindrical muscle, in part covered by the clavicle, of the pectoralis minor called the subclavius.

Origin of the PECTORALIS MINOR. From the fore and outer part of the third, fourth, and fifth ribs.

Insertion. Into the extremity of the coracoïd process of the scapula.

Use. To carry the scapula downwards, forwards, and inwards.

Origin of the SUBCLAVIUS. Tendinous from the cartilage of the first rib.

Insertion. Into the middle half of the under surface of the clavicle.

Use. To carry the clavicle downwards, forwards, and inwards. The three preceding muscles taken with the clavicle form the anterior wall of the axilla. The axilla is an intermuscular passage, which transmits the artery, vein, and nerves of the upper extremity; being open above and below, and parallel to the upper part of the chest.

The chest is clothed laterally, and the inner wall of the axilla formed by the serratus magnus.

Origin of the SERRATUS MAGNUS. By nine fleshy digitations from the fore and outer part of the nine superior ribs.

Insertion. Into the anterior margin of the base of the scapula.

Use. To carry the scapula forward, and to direct the glenoïd cavity upward.

The intercostal muscles, which close the intervals of the ribs, may now be examined.

The INTERCOSTALES EXTERNI run from rib to rib in a direction downward and outward, or downward and forward, in successive fasciculi, which begin at the transverse processes of the dorsal vertebræ, and are discontinued anteriorly a little before the attachment of

each rib to its cartilage: their place is afterwards supplied by aponeurotic fibres similarly disposed.

On raising the intercostales externi the INTERCOSTALES INTERNI are seen, the fibres of which decussate the former series; being directed downward and outward; or downward and backward: the intercostales interni commence at the sternum, and become imperfect at the angles of the ribs.

Use. To bring the ribs nearer to each other.

The intercostal muscles are almost exclusively employed in respiration: the muscles exterior to them are occasionally only interested in this function. The present stage of the dissection allows of a complete explanation of the mechanism of breathing.

The mechanism of breathing consists in contrivances for alternately enlarging and diminishing the cavity of the chest.

1. One contrivance is that of a muscular floor to the thorax, which by its contraction gives height to the cavity.

2. The ribs are so articulated with the spine and sternum, that they admit each of some rotatory motion upon these attachments; during which, as the ribs ascend, the breadth of the chest is increased, and *vice versâ*.

3. The ribs are so articulated with the spine, that their sternal extremities, together with the sternum, may be slightly raised or depressed; but the sternal attachment is at a lower level than the spinal attachment of each rib: hence it follows, that the act of raising the ribs must enlarge the depth of the chest.

It may be remarked, that the same muscles, all those, namely, the lowermost attachments of which are to a

rib, contribute equally to enlarge both the depth and the breadth of the chest: that muscles of the opposite class again diminish the chest in both dimensions; and, finally, that all those muscles, which diminish the width and depth of the abdomen, contribute to diminish the height of the chest.

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§ V. OF THE THORACIC VISCERA.

Dissect off the intercostales interni: the surface exposed is the cellular side of a serous membrane, through which the lungs are seen in contact with the parietes of the chest. Puncture this serous membrane, and the lungs recede, through their elasticity, from the ribs.

Saw through the ribs on either side from the second to the seventh inclusively, as far back as is consistent with preserving the muscles not yet dissected: cut through the cartilages of the same ribs, on the fore part, close to the rib below and to the sternum above, and remove these ribs. You thus lay open the two lateral cavities of the chest. The serous membrane, lining each, is called a *pleura*. You trace this membrane, 1st, investing the lung; and, secondly, reflected from the root or attachment of the lung to the spine behind, and to the sternum before: it subsequently invests the ribs, intercostal muscles, and diaphragm. The pleura covering the lung is called *pleura pulmonalis;* the rest, *pleura reflexa*. Those parts of the pleuræ reflexæ, which are more or less parallel to the median plane, and form a septum, partitioning the chest from

before backward, between the laminæ of which the heart and great vessels are contained, constitute the *mediastinum:* parts of each pleura reflexa again are named after the surfaces they cover, as *pleura pericardiaca, pleura costalis, pleura diaphragmatica.*

If you distend the lungs by blowing air down the windpipe, they are seen to assume the conical shape of the thorax; concave below, each is convex externally and behind; internally each is unequally excavated; the anterior margin is sharp and irregular. The lung of the right side is the larger of the two: each is divided by an oblique fissure into an *upper* and an *under lobe;* the under lobe of the right lung is in almost every case subdivided by a vertical fissure into an anterior and posterior portion: these fissures extend completely through the lungs.

The pleura is reflected off from the inner surface of each lung, near its posterior margin; the reflexion occurs before the dorsal vertebræ, from the fourth to the eighth inclusively; opposite to the seventh and eighth vertebræ the reflexion is simple, consisting of no more than the two layers of pleura, the one from the anterior, the other from the posterior surface of the lung: this part is termed the *ligament of the lung;* but many substances are contained between the upper part of the layers of reflected pleura, which are said, with their contents, to form the *root of the lung.*

The substances contained in the root of the lung afford a clue to its composition: before and below, two great veins on the left side and three or two on the right called *pulmonary veins,* which return the florid blood from the lungs, are seen emerging from the lungs, and

passing transversely inwards towards the heart: behind the uppermost vein, a division of the *pulmonary artery*, which conveys the black blood from the heart to the lung, is seen: behind this vessel again, the *bronchus* or continuation of the trachea descends obliquely, composed of incomplete rings of cartilage united by membrane. This structure is gradually lost, and the tubes appear wholly membranous, as you follow the subdivisions of the bronchi in each lung towards their final termination in minute air cells, which are best seen by inflating, drying, and making sections of lungs. You may further notice, upon the root of the lung, the pulmonic plexus of nerves derived from the par vagum; a plexus of absorbent vessels easily traced from the numerous absorbent glands situated around the bronchi; and, finally, the bronchial arteries and veins, small vessels, which creep along the bronchi, and are destined for the nutrition of the lungs.

The pleura reflexa of either side passing forward from the root of the lung invests the pericardium or serous membrane of the heart: between these two serous membranes, the phrenic nerve descends to the diaphragm. The heart appears to project into the left cavity of the chest.

Cut through the reflected pleura and pericardium on the left side, longitudinally, and expose the heart. Its fleshy substance is seen shining through the *pericardium verum*, the thinness of which is contrasted with the strength of the *pericardium reflexum:* the latter is distinctly separable into two laminæ; an inner, the true continuation of the serous sac, and an outer adventitious tunic, which resembles a dense fascia.

The *heart* is seen to be flat below, where it rests on the tendon of the diaphragm: convex above; thick in substance, unattached, and ending in a point before and to the left; of thinner substance, of greater breadth, attached by numerous vessels and the reflection of the pericardium behind and to the right at its base. A deep transverse furrow separates the thinner from the thicker portion: a shallow longitudinal furrow at right angles to this, and marked anteriorly by the course of the coronary vessels, separates the heart into a right or anterior portion, and a left or posterior. The furrow runs in such a manner as to give the apex of the heart entirely to the latter portion. The shallow longitudinal furrow marks the course of the septum, which divides the heart into a right and a left cavity, unconnected with each other: the transverse furrow marks the subdivision of each cavity into an anterior and posterior chamber.

The anterior chambers are the *ventricles*, the posterior the *auricles* of the heart.

The auricles are so named from the anterior appendage of each, which is directed towards the opposite side and towards its fellow.

Draw the heart forwards and to the left: you notice the surface of the right auricle, in shape nearly triangular; the anterior corner is prolonged to form the appendage just noticed: the upper and posterior corner receives the vena cava superior, the lower and posterior receives the vena cava inferior. Slit up the fore part of the superior cava longitudinally, and continue the incision so as to lay open the auricle to within a third of an inch of the transverse furrow; next carry an incision from the anterior extremity of the last in a di-

rection parallel to the transverse furrow, so as to open the inferior cava upon the fore part. On reflecting the cut portion, you notice the appearance of parallel muscular fasciculi called *musculi pectinati*, which run forward towards the transverse furrow, become reticular in the appendage, but are lost at the transverse furrow, and on the surface opposite or *septum auricularum*.

From the fore part of the opening of the inferior cava into the auricle a semilunar reflexion of membrane, frequently reticular near its edge, of unequal depth in different subjects, sometimes thickened by containing muscular fibres, passes backward and to the left side, to terminate on the septum. This process is called the *Eustachian valve*. Behind it is seen an oval fossa, sometimes obliquely pervious at one edge, so that a communication remains in such a case for life between the right and left auricle: the depression is termed the *fossa ovalis*, and marks the place of the foramen ovale in the fœtus. The object of the Eustachian valve, which continues the left margin of the inferior cava into the cavity of the auricle, is to cause the axis of this vein to correspond with the axis of the foramen ovale, thus to facilitate the passage of blood from the umbilical vein into the left auricle during fœtal life.

Before the attachment of the Eustachian valve, an oblique oval opening is seen at the lower part of the septum guarded by a semilunar valve, generally reticular; this is the opening of the *coronary vein* of the heart. The smooth and contracted margin, which projects internally in the line of the transverse furrow, is called the *ostium auriculæ:* it leads into the right ventricle, the cavity of which may be opened by prolonging the longitudinal incision first directed.

The right ventricle is seen to be about a third of an inch in thickness, its cavity triangular, and capable, with each of the four chambers, of containing easily two ounces of fluid: its inner surface is reticular, with three or four more prominent muscular fasciculi, which are called *columnæ carneæ*, and give attachment to several thin tendons, or *chordæ tendineæ:* these last again are continuous with the floating edge of a membranous process, derived from the margin of the ostium auriculæ, and called the *tricuspid valve* from its three projections, the adjoining surfaces of any two of which receive the cordæ tendineæ of a single columna carnea. The tricuspid valve is upwards of half an inch deep at its points, and more than a third of an inch at its narrowest; it is somewhat thicker than would result from a mere reduplicature of the inner membrane of the ventricle, particularly for a line within its floating margin. At its upper and posterior corner the surface of the right ventricle becomes smooth; its cavity approaches a cylindrical form, and is at this part termed the *ostium ventriculi*, which leads directly into the pulmonary artery.

In cutting up the ostium ventriculi, observe, before opening the artery, the appearance of its *semilunar valves* from the ventricle: these seem to be three semilunar slips of folded membrane attached by their convex margins to the root of the artery; cut open the artery longitudinally between any two of the valves, which may thus be preserved entire: on pressing them down, you observe in what way their unattached edges are calculated to meet during the systole of the artery, so as to prevent the reflux of the blood into the ventricle; that each unattached margin is strengthened by

a small thickening just behind its centre; and, finally, that the artery is slightly dilated behind each of these valves.

Now turn the heart towards the right, and, by a longitudinal incision, lay open its left cavity; you notice in the left auricle the entrance of the three right pulmonary veins at its right side; of the two left pulmonary veins upon the left; the absence of musculi pectinati, of valves to the veins, and of a distinct margin to the fossa ovalis: but the ventricle seems of triple the thickness of the right, is cylindrical, its valve is thick, has two points, and is termed *mitral;* the chordæ tendineæ are stronger, the columnæ carneæ but two in number; the artery finally, which springs from it, the *aorta*, has thicker coats and stronger semilunar valves than the pulmonary artery.

It remains to observe the relative place of the vessels attached to the heart, the extent to which they are covered by the pericardium, and the mode in which the heart is secured in its place.

1. The venæ cavæ are vertical in their course, and are placed to the right and front of the base of the heart. The pulmonary artery is inclined upward, backward, and rather to the left side; the aorta rises behind the latter, and is inclined upward, forward, and to the right side; the pulmonary veins are behind the other vessels, and pass transversely to the left and right.

2. The pericardium invests the inferior cava for three or four lines, and the superior cava for nearly three inches; the pulmonary artery and aorta for the same extent; and the pulmonary veins for about an inch

and a half; but in each case covers more of the anterior than of the posterior surface of these vessels.

3. The pericardium reflected off from the great vessels forms a sac firmly coherent with the upper surface of the diaphragm, to which it fastens the heart: but the pericardium has been found wanting, and the heart covered by the pleuræ; in which case, the support of the heart must have been mainly derived from the attachments of its vessels.

The three serous cavities of the chest have been now explored; but certain cellular regions or cavities are yet to be examined. Two of these are known as, 1st, the *anterior*, and 2dly, the *posterior mediastinal cavity*.

1. The two pleuræ are in contact anteriorly to the heart, and tend to the sternum, whence they are reflected to line the ribs. The cellular space between the sternum before, and the pleuræ behind and laterally, is the *anterior mediastinal cavity;* to display it, cut through the costal cartilages, which remain attached to the lower part of the sternum on either side; and the fibres of the diaphragm which adhere to these and to the ensiform cartilage, and raise the sternum, between which and the pleuræ a broad triangular cellular cavity is thus formed, being an artificial expansion of the anterior mediastinal cavity: in it you notice laterally, at either margin, the internal mammary artery and veins, attended by several lymphatic glands marking the ascent of absorbent vessels on either side of and parallel to the median plane. These lymphatic vessels are principally derived from the upper surface of the liver, in the ligaments of which they ascend, and reach and perforate the diaphragm.

Behind the upper bone of the sternum, a yellowish mass having the appearance of fat is found; this is the *thymus gland*, which in the fœtus and for some years after birth appears a peculiarly organized part; being then very vascular, of a yellowish grey colour, and consisting of two distinct and unconnected lobes, one on either side of the median plane, which are again resoluble, each into minor portions, connected by cellular membrane only; they are hollow, and contain in their cavities a turbid serum.

When the sternum is thus raised, the thin muscular fasciculi of the TRIANGULARIS STERNI of either side, are seen to extend from their *origin* at the posterior surface of the ensiform cartilage, and of the edge of the sternum adjoining the cartilages of the four lowest true ribs, to an *insertion* into the junction of the shafts and cartilages of the third, fourth, fifth, and sixth ribs. The triangularis sterni may contribute to diminish the transverse diameter of the chest upon a principle explained in the last section.

The *posterior mediastinal cavity* is the corresponding cellular region between the pleuræ before and laterally, and the dorsal vertebræ behind: its contents are of more importance; and before their dissection, it is as well to have injected mercury into the thoracic duct from the abdomen, where it is readily found between the aorta and right crus of the diaphragm. Raise and turn the left lung over to the right side, so as to expose the reflexion of the pleura from the posterior surface of its ligament to the spine: divide the pleura longitudinally, midway between the root of the lung and the spine, and dissect it off from the parts it covers: these are the contents of the posterior mediastinal cavity,

which you have thus laid open from the left side. You meet with,

1. The *aorta* descending along the left side of the spine, to which it became attached at the third or fourth dorsal vertebra.

2. Anterior to, and to the right of the aorta, though still disposed rather to the left of the median plane, the *œsophagus* with the *par vagum* distributed upon its muscular coat, and descending like the aorta parallel to the spine.

3. The *thoracic duct*, which is closely applied to the spine, and ascends somewhat obliquely from its position between the aorta and right crus of the diaphragm, to the left side of the mediastinal cavity above.

4. Upon the right side of and adherent to the spine, the *vena azygos*, or common trunk of the intercostal, œsophageal, and bronchial veins: it enters the vena cava superior about three inches above the heart, bending forwards over the right bronchus.

5. Laterally, at the lower part of the posterior mediastinal cavity, the *splanchnic nerves*, which are nearly, if not fairly, included in this region.

Now between what strictly belongs to the anterior and posterior mediastinal cavities, the superior cava, the trachea, and the arch of the aorta are placed.

The *superior cava* ascending behind the right margin of the sternum, divides opposite to the second dorsal vertebra into a short venous trunk, which passes to the right, and subdivides into the right subclavian and internal jugular veins, and a longer trunk, which passes to the left, and subdivides in a similar manner.

The *aorta* ascends behind the pulmonary artery, inclined to the right and slightly forward to the level of

the juncture of the cartilage of the right second rib with the sternum, then extends backwards and to the left arching over the left bronchus, and being placed to the left of the trachea: its highest elevation reaches nearly to the lower margin of the cartilage of the first rib: the aorta then descends inclining backward and to the left, and reaches the spine opposite the third dorsal vertebra. Near the posterior limb of its arch, the aorta receives on its concave surface a ligament half an inch in length from the point of bifurcation of the pulmonary artery. This ligament was in the fœtal state a tube, and called the *ductus arteriosus*, through which the blood of the pulmonary artery flowed into the aorta.

The *trachea* is a long tube, composed of about fifteen incomplete rings of cartilage, each about a quarter of an inch in depth, and united by as much elastic ligament. The substance which closes the tube behind is of some thickness: the outer layer seems of white reticular elastic substance, containing many small oval glandular bodies: on dissecting this layer off, a series of strong transverse muscular fibres is found, connecting the opposite extremities of each cartilage: on carefully dissecting this layer away, little is left except the fine mucous lining of the wind-pipe, which seems, nevertheless, to have a delicate layer of longitudinal fibres blended with its cellular surface.

Opposite to the third dorsal vertebra, the trachea divides into the *bronchi* two tubes similar to it in structure. The right is the shorter and more capacious: the left is the longer, but of less calibre, passing to the more remote and smaller lung of the left side: the arch of the aorta is thrown over the former. The chest is closed at its upper part by the *fascia cervicalis profunda*,

which extends across from the vertebræ to the sternum, and from the first rib of one side to the opposite. The fascia cervicalis profunda is perforated by the thoracic duct, and by the lymphatic trunks of the anterior mediastinal cavity, by the nerves and blood vessels of the neck passing to or from the thorax, by the trachea and œsophagus.

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§ VI. OF THE CUTANEOUS MUSCLES OF THE HEAD, FACE, AND THROAT.

THESE have for the most part an attachment to the skin; a circumstance, which together with their smallness and the pale colour of their fibres renders their dissection difficult.

These muscles are subservient to the organs of the special senses, and contribute to the changes of feature, by which passion and character are expressed.

Make an incision through the integuments covering the superior transverse ridge of the occipital bone: make a second at right angles to this, extending to the forehead in the median plane, and, raising the skin on either side, dissect the muscular and tendinous expansion which covers the pericranium.

The OCCIPITO-FRONTALIS, as this expansion is termed, *rises* fleshy from the superior transverse ridge of the occipital bone and soon becomes a thin flat tendon centrally and at its edges; the muscular fibres are prolonged intermediately to the length of three or four inches; the tendon adheres slightly to the pericranium, firmly to the integuments; it becomes thinner forwards, where it terminates in a second fleshy expansion, cover-

ing the forehead, thicker on either side than in the middle; this second series of fibres passes down to be *inserted* into the skin and flesh behind the whole extent of either eyebrow; to be attached to the nasal process of the superior maxillary bone, where its fibres are continuous with those of the levator labii superioris alæque nasi; and finally to be attached to the nasal bone, where its fibres are blended with those of the compressor naris.

When both muscular portions, or the anterior only, act, the forehead is wrinkled transversely, and the eyebrow raised; the posterior acting alone smooths and expands the scalp covering the forehead.

As the skin is dissected from the eyelids, the circular fibres, called the orbicularis palpebrarum, are exposed. A small round ligament, a quarter of an inch in length, called the *tendo oculi*, extends transversely from the nasal process of the superior maxillary bone to the inner canthus of the eye. The ORBICULARIS PALPEBRARUM *rises* from either edge of this ligament, and in addition from the os frontis at the inner part of the margin of the orbit, and from the os maxillare superius for half an inch of its nasal process and orbital margin. From these attachments circular fasciculi forming a thin layer two inches in breadth are extended round the margin of the orbit. The fibres are delicate, that are placed on the eyelids, which they are *used* to close by depressing the upper: the exterior fibres are coarser, and are chiefly *used* as antagonists to the occipito-frontalis to depress or fix the eyebrow.

On cutting through those fibres of the occipito-frontalis, which cover the internal angular process of the os frontis, a small muscle called the CORRUGATOR

SUPERCILII may be exposed, which passes upwards and outwards from an *origin* upon this surface of the os frontis, to be *inserted* into the flesh behind the eyebrow. The corrugator supercilii is *used* to draw the inner corner of the eyebrow downward and inward.

The tendo oculi is a guide to the incision upon the lacrymal sac: from a line below the outer attachment of the tendon cut for half an inch obliquely downwards and outwards; the incision will be found to have exposed or laid open the lacrymal sac. A probe is readily passed in the natural state from the nostril into the lacrymal sac: for this object the probe should be bent three quarters of an inch from its rounded end, which should be carried along the floor of the nostril about an inch, and then raised outward, between the superior maxillary bone and the inferior turbinated bone, in such a manner as that it may slide along the mucous surface into the vertical aperture of the duct.

When the integuments are dissected from the nose a thin triangular muscle called the COMPRESSOR NARIS is exposed, which *rises* by its base from the suture of the ossa nasi and from the fore part of the cartilago septi-narium, and is *inserted* into the flesh, skin, and cartilage, about the posterior edge of the ala of the nose. When the latter part is fixed, the muscle may contribute to narrow the nostril: its direct use seems to be to expand the nostril.

The LEVATOR LABII SUPERIORIS ALÆQUE NASI is the muscle next in order: its thin fibres half an inch in breadth *arise* from the nasal process and adjoining orbital margin of the superior maxillary bone, and descend towards the upper lip to be *inserted* in part with the last muscle at the ala nasi, in part into the flesh of the upper lip; the nome of this muscle denotes its *use*.

On the outside of the levator labii superioris alæque nasi, a muscle of similar appearance and separated from it by a membranous line only, the LEVATOR LABII SUPERIORIS PROPRIUS, descends from its *origin* along the orbital margin of the superior maxillary bone to be *inserted* into the flesh of the upper lip; its name denotes its *use*.

On separating the preceding muscles at the membranous line alluded to, the DEPRESSOR LABII SUPERIORIS ALÆQUE NASI is seen, a deeply seated muscle, which *rises* from the alveolar process of the dens cuspidatus, and passing obliquely forwards is *inserted* into the ala of the nose, having the *use* its name denotes.

The NASALIS LABII SUPERIORIS is a thin slip of muscle, which passes backward from the tip of the nose below the side of the septum, and is continued behind the edge of the furrow of the upper lip, to be blended with the flesh of the latter. In its action it curves the tip of the nose downwards and raises the upper lip.

The ZYGOMATICUS MINOR is a thin slip of muscle, which *rises* from the fore part of the malar bone, and passes obliquely forward and downward to an *insertion* into the flesh of the upper lip next to the levator labii superioris proprius; it draws the lip upward and outward.

Of the preceding six muscles, one belongs to the nose, two belong to the lip exclusively, and three are common to the nose and lip: then follow four muscles, which are *inserted* into the flesh at the angle of the mouth.

1. The ZYGOMATICUS MAJOR *rises* from the fore and outer part of the malar bone, is more than half an inch in breadth, and descends obliquely forward to its

insertion; its *use* consists in drawing the corner of the mouth backwards and upwards.

2. The LEVATOR ANGULI ORIS is a deep-seated muscle which descends obliquely forwards and outwards behind the levator labii superioris proprius and the zygomaticus minor, from an *origin* upon the superior maxillary bone below the foramen infra orbitale; it is *used* to draw the corner of the mouth upwards.

3. The BUCCINATOR, the muscle of the cheek, *rises* from the alveolar processes of the upper and of the lower jaw as far forward as the first dens bicuspis, and from the ascending branch of the lower jaw: in its action it retracts the corner of the mouth, or if that point be fixed by the orbicularis oris, it flattens the convexity of the cheek. Opposite to the anterior molaris of the upper jaw, the buccinator is perforated by a conical duct, the aperture of which may be seen within the mouth. The duct passes backward immediately below the integuments and parallel to the zygoma to the largest of the salivary glands about the fauces. This gland, which is termed the *Parotid*, occupies the space between the branch of the lower jaw and the mastoïd process of the temporal bone; it is flat externally, but irregularly prominent internally. A small oval salivary gland, the *socia Parotidis*, adheres to the upper margin of the duct at the distance of half an inch from the parotid.

4. The DEPRESSOR ANGULI ORIS is a triangular muscle which *rises* from two inches of the base of the jaw, and tapers to the corner of the mouth, which in its action it directly depresses.

The rhomboïdal muscle, which emerges from below the anterior margin of that last described, and continues to take an *origin* further forward from the base of the

jaw, is the DEPRESSOR LABII INFERIORIS: its parallel fibres blended with fat ascend obliquely forward and are *inserted* into the margin of the under lip, which they tend to depress and retract.

The common antagonist of the numerous muscles, which have been thus traced to insertions in the flesh of the lip, is the ORBICULARIS ORIS, the fibres of which extend from corner to corner of either lip, and constitute a sphincter muscle, nowhere attached to bone, but intimately blended with the insertions of the muscles alluded to, its opponents: at the corner of the mouth a general decussation takes place of all the fasciculi, which are involved in it.

On cutting through the inner fibres of the depressor labii inferioris, a muscle of closer grain, the LEVATOR MENTI, is seen to *arise* from the side of the symphysis of the jaw, whence it expands to be *inserted* into the flesh of the chin and under lip: its lower fibres descend, and the principal action of the muscle is what its name expresses.

To complete the list of cutaneous muscles, those of the ear and that of the neck may be dissected at this time.

The basis of the external ear is a single cartilage so incurvated at its lower part as to form an incomplete tube, the conical aperture of which is termed the *concha;* the fossa above this is called the *scaphoïd cavity*, the borders of which meeting form an eminence directed downward and then incurvated forward, and termed the *antihelix*, as opposed to the marginal fold of the cartilage, called the *helix*. Of the surface, which encloses the concha below, the anterior part is called

the *tragus;* the posterior, which is finally continuous with the antihelix, the *antitragus.*

Laterally the tendon of the occipitofrontalis has no definite termination; perhaps it may be described as giving *origin* to a broad thin muscle, the fibres of which converge to be inserted into the convex surface of the scaphoïd fossa. This muscle is termed the ATTOLLENS AURIS.

A few fibres constituting the ANTERIOR AURIS may be traced from the root of the zygoma to the helix.

On exposing the posterior surface of the ear the RETRAHENS AURIS may be made out to *rise* from the mastoïd process of the temporal bone, and to be *inserted* into the back of the concha; just below and nearly parallel to this, a second similar muscle is often met with, called the RETRAHENS ALTER.

The preceding muscles move the external ear upon the head. Muscles still smaller are found upon the surfaces of the cartilage, by which its form is modified. These are the TRANSVERSUS AURIS, consisting of fibres running from the helix to the concha on the back part of the ear: the HELICIS MAJOR and HELICIS MINOR, which ascend upon the fore part of the helix: the TRAGICUS and ANTITRAGICUS, the thin membraniform fasciculi of which are disposed longitudinally upon the convex surfaces of the tragus and antitragus. The general effect of these muscles is to expand the different plaits and folds of the external ear.

The cutaneous muscle of the neck is called the PLATYSMA MYOÏDES; to expose it, make an incision through the skin from the middle of the clavicle obliquely upwards to the base of the jaw: this incision

is nearly parallel to the course of the fibres of the platysma myoïdes, which is about four inches broad, and extends from the skin below the clavicle to the skin above the base of the jaw. The contraction of the unequal fibres of this muscle throws the integuments of the neck into shallow furrows parallel to the direction of the muscle.

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§ VII. OF THE MUSCLES OF THE LOWER JAW AND THROAT.

Four powerful muscles on either side contribute to raise the lower jaw, and to carry it forward or laterally as in the mastication of food.

1. The MASSETER is that muscle, over which the duct of the parotid gland passes: it *rises* tendinous and fleshy from the inferior margin of the os malæ, and the adjoining processes of the temporal and superior maxillary bones. The fibres of this muscle are covered near their origin by a thick layer of tendon, from which processes descend between the muscular fasciculi: these are for the greater part inclined obliquely backward, and are *inserted* into the outer surface of the angle and branch of the lower jaw. A smaller portion derived from the zygomatic process of the temporal bone descends with a moderate inclination forward to be inserted into the branch of the lower jaw, within and above the fibres of the greater portion. The masseter is *used* to carry the lower jaw upward, forward, and to the same side.

A strong membranous expansion called the *fascia*

temporalis extends from the upper margin of the zygoma to the spine of the os frontis and the semilunar line upon the parietal bone. Divide this fascia by an incision from the middle of the zygoma, and dissect it from its adhesions to the following muscle.

2. The TEMPORAL MUSCLE *arises* from the surfaces of the parietal bone, and of the temporal plates of the frontal, sphenoïd and temporal bones, which the attachment of the preceding fascia circumscribes, and from the inner surface of the malar bone. Its fibres converge to be inserted by a strong oval tendon into the coronoïd process of the lower jaw. The temporal muscle is *used* to raise the lower jaw.

Saw through the zygoma at either extremity, and remove it with a portion of the masseter: by this means the insertion of the temporal muscle is more distinctly brought into view. Now saw through the lower jaw anterior to the insertion of the masseter, evert its separated branch, and detach from its margin the origin of the buccinator.

3. The muscle is termed the PTERYGOÏDEUS INTERNUS, which is now exposed from its *origin* upon the whole inner surface of the pterygoïd fossa, to its *insertion* into the inner surface of the angle and branch of the lower jaw: it is *used* to carry the lower jaw upward, forward, and towards the opposite side.

4. The PTERYGOÏDEUS EXTERNUS crosses horizontally over the preceding: it *arises* from the outer surface of the external pterygoïd process, and is *inserted* into the fore part of the condyle of the lower jaw: it is *used* to carry the lower jaw forward and towards the opposite side.

The muscles of the throat are now to be dissected.

Divide the platysma myoïdes in a line from the upper part of the clavicle to the mastoïd process of the temporal bone, and dissect the following thick muscle which extends between these two points.

The STERNO-CLEIDO-MASTOÏDEUS *rises* by a round tendon from the fore part of the triangular bone of the sternum, and by muscular and tendinous fibre from the inner third of the superior margin of the clavicle; these two portions coalesce, and ascend obliquely backward to be *inserted* into the margin of the mastoïd process, and into part of the transverse ridge of the occipital bone. The sterno-cleido-mastoïdeus is *used* to bend the neck forward and to the same side, to incline the head to the same side, and to rotate it towards the opposite.

If the sterno-cleido-mastoïdeus be divided and either portion dissected up, the surface of the neck then exposed is found clothed by a fascia, called the *fascia cervicalis superficialis;* which is firmly connected above with the parotid gland and base of the jaw; extends forward to the median plane and backwards over the muscles of the spine. The neck appears to be naturally divided into two regions: behind is situated the vertebral column with its muscles; before, the organs of voice and deglutition form a compact and moveable mass, the parts of which are indistinctly seen through the fascia cervicalis superficialis. The vessels and nerves which pass from the chest to the head, are lodged in the furrow formed on either side of the meeting of the throat and the cervical vertebræ.

On examining the front of the throat you discover the trachea emerging from the chest, through the fascia cervicalis profunda. Opposite to the fifth cervical ver-

tebra the windpipe alters its form; you notice at this level a ring broader than those of the trachea, which is the fore part of the *cricoïd cartilage*, and above this an angular projection of cartilage an inch deep, which is the fore part of the *thyreoïd cartilage*. These two cartilages are connected together by elastic ligament: they are the principal pieces in the contrivance of the *larynx* or organ by which the vocal sounds are produced. Finally, the thyreoïd cartilage is suspended by elastic ligament from the *os hyoïdes:* of which you notice, 1st, the *body* or *base* anteriorly convex; 2dly, the *cornua* projecting nearly horizontally backwards, and connected each by a round ligament to the extremity of the styloïd process of the same side; 3dly, the *graniform processes* extending obliquely upwards, outwards, and backwards from the *angle*, at which the body and cornu meet on either side.

The os hyoïdes supports the flesh of the tongue, and gives attachment to the muscles which depress the lower jaw. A conical muscular sac, which forms the upper part of the alimentary canal, and is termed the *Pharynx*, adheres to the cornua of the os hyoïdes, and to the sides of the larynx, behind the lower part of which it tapers to narrower dimensions; the cylindrical tube continuous with the pharynx is called the *œsophagus:* the larynx is situated before the pharynx: the trachea before the œsophagus. Distend the pharynx by means of horse hair introduced through the mouth, and dissect the fascia cervicalis superficialis from the muscles, which intervene between the os hyoïdes and the sternum.

Parallel to and close upon the median plane a thin muscle of an inch in breadth, called the STERNO-HYOÏ-

DEUS, ascends from a triple *origin* upon the posterior surface of the sternum and sternal end of the clavicle, and from the cartilage of the first rib, to be *inserted* into the base of the os hyoïdes; it is *used* to depress the os hyoïdes.

The OMO-HYOÏDEUS is the muscle *inserted* into the os hyoïdes externally to the preceding, from whence you may trace its course nearly directly downwards to within two inches above the clavicle where it forms a tendon; from this tendon a second fleshy portion is derived obliquely to one, or other, or both margins of the notch of the scapula. The omo-hyoïdeus is *used* to draw the os hyoïdes, and with it the larynx and pharynx, downwards, backwards, and towards the same side.

Immediately behind the sterno-hyoïdeus, another similar but broader muscle, the STERNO-THYREOÏDEUS, ascends from an *origin* upon the posterior surface of the sternum and the upper surface of the cartilage of the first rib to an *insertion* into the oblique ridge of the thyreoïd cartilage, which it is *used* to depress.

The same action is continued on to the os hyoïdes by means of the THYREO-HYOÏDEUS, which *rises* from the oblique ridge of the thyreoïd cartilage and ascends in parallel fibres to be *inserted* into the base and cornu of the os hyoïdes.

Finally, the CRICO-THYREOÏDEUS *arises* behind the preceding muscles from the anterior surface of the cricoïd cartilage, and is *inserted* into the outer two-thirds of the base of the thyreoïd cartilage; it is *used* to shorten the larynx.

Upon the fore part and sides of the trachea the THYREOÏD GLAND is seen. This gland is highly vascular, has no excretory duct, but is in structure cel-

lular; its cells contain a serous fluid: it consists of two lateral portions from an inch to an inch and an half in depth, which ascend as high as the posterior corner of the base of the thyreoïd cartilage; and of an isthmus, generally about half an inch in height, which passes before the second and third rings of the trachea. It not unfrequently happens, that a narrow pyramidal process ascends from the isthmus of the thyreoïd gland and adheres to the fore part of the cricoïd and thyreoïd cartilages.

The windpipe may be opened to relieve spasmodic constriction of the aperture of larynx: for this object a longitudinal incision may be made through the skin, anterior to the membrane which connects the thyreoïd and cricoïd cartilages; that membrane may be then divided, and if a larger opening appear necessary, a portion of the cricoïd cartilage removed. The trachea below the thyreoïd gland is so remote from the surface, and so many veins are interposed, that its division, though in some cases necessary, would require more time than the operation above recommended.

The œsophagus may be readily exposed in a living person after an incision along the anterior margin of the sterno-cleido-mastoïedus; it is commonly found situated rather to the left and behind, than strictly behind the œsophagus.

Now dissect the fascia cervicalis from the os hyoïdes upwards, so as to show the muscles which extend between the os hyoïdes and the bones of the head.

The BIVENTER MAXILLÆ INFERIORIS is the outermost: it *rises* from the groove within the mastoïd process of the temporal bone, and gradually terminating in tendon, descends to the angle of the os hyoïdes; its

tendon is confined at this point by a cellular loop, from which it again rises, passing forwards and upwards, and forming a second fleshy portion *inserted* into the inner part of the base of the lower jaw: its tendon, before its connection with the os hyoïdes, perforates a muscle called the STYLO-HYOÏDEUS, which rises from the outer and upper part of the styloïd process, and is *inserted* into the angle of the os hyoïdes.

Between these muscles and the lower jaw, the lower margin of an oval salivary gland is seen; this is the *submaxillary gland*, its duct opens by the side of the frænum linguæ: turn the gland outwards without detaching it, but cut through the anterior attachment of the biventer.

The MYLO-HYOÏDEUS is thus exposed; the fibres of which *rise* from the upper part of the base of the os hyoïdes, and between this bone and the symphysis of the jaw by a membranous line common to the muscle of the opposite side, whence they pass obliquely upward and outward to be inserted into the oblique ridge of the lower jaw. Cut through the insertion of this muscle, and turn it down: another oblong salivary gland, the *sublingual*, is found to have been interposed between this muscle and the mucous membrane of the mouth. The ducts of the sublingual are six or seven in number, and open in the furrow below the side of the tongue. The sublingual and submaxillary glands frequently coalesce at the outer margin of the mylo-hyoïdeus.

The GENIO-HYOÏDEUS is a small cylindrical muscle, situated immediately above the anterior margin of the mylo-hyoïdeus: it *arises* from the upper margin of the body of the os hyoïdes, and is inserted into the lowest tubercle of the symphisis of the jaw. When the lower

jaw is fixed, the four preceding muscles unite in raising the os hyoïdes: on the contrary, when the os hyoïdes is fixed, all but the stylo-hyoïdeus tend to depress the lower jaw. The stylo-hyoïdeus again inclines the os hyoïdes backwards as well as raises it, the biventer simply raises it, the other two carry it forwards, and thus are employed in protruding the tongue.

1. The four muscles which form the substance of the tongue may be now dissected. The GENIO-HYO-GLOSSUS, the innermost and largest, *rises* from the upper tubercle of the symphysis of the jaw, whence its fibres spread backwards to a broad *insertion* extending from the os hyoïdes to the tip of the tongue. This muscle forms, with its fellow, more than half the substance of the tongue; its inferior fibres are *used* to raise and carry forward the os hyoïdes: the anterior fibres draw back the tip of the tongue, or depress it over the margin of the under lip.

2. The LINGUALIS consists of a fasciculus of longitudinal fibres, which occupy the whole length of the dorsum of the tongue externally to the muscle last described; it shortens the tongue and raises its point.

3. The STYLO-GLOSSUS *rises* from the fore and upper part of the styloïd process, whence it descends to be *inserted* into the side of the tongue near its base: it is *used* to retract, and to give breadth and concavity to the surface of the tongue.

4. The HYO-GLOSSUS is a flat muscle, which *rises* from the adjoining halves of the base and cornu of the os hyoïdes and ascends to be *inserted* into the side of the tongue, near its base: it is *used* to retract and give breadth and convexity to the surface of the tongue.

The tongue, as regards the preparation of the ali-

ment for digestion, is employed to appreciate its savor, to place it under the pressure of the teeth, and finally to thrust it back into the pharynx: at this time the pharynx is raised by all the muscles which carry the os hyoïdes upwards.

The following muscle is specifically used to expand as well as to raise the pharynx on this occasion.

The STYLO-PHARYNGEUS *rises* from the inner and upper part of the styloïd process, and is inserted into the side of the pharynx immediately above the cornu of the os hyoïdes.

The muscular clothing of the pharynx is arranged in three separate portions, termed the upper, middle, and inferior constrictors of the pharynx.

The CONSTRICTOR SUPERIOR PHARYNGIS is attached above to the basilar process of the occipital bone, laterally to the fore part of the ascending branch of the jaw, where its fibres are blended with those of the buccinator; posteriorly a median membranous line connects the two portions of the muscle. The constrictor superior on the one hand assists in raising the pharynx upon the morsel to be swallowed, and on the other compresses it when within its grasp.

The food is thus urged down the canal into the grasp of the CONSTRICTOR MEDIUS PHARYNGIS, which *rises* from the cornu of the os hyoïdes, its upper fibres ascending so as to cover the lower of the preceding muscle: all its fibres of the one side are united behind with those of the opposite at a median membranous line.

The constrictor medius urges the food within the grasp of the CONSTRICTOR INFERIOR PHARYNGIS,

which *rises* from the transverse ridge and posterior edge of the thyreoïd cartilage and from the side of the cricoïd: its fibres are disposed like those of the preceding, so as above to cover part of the constrictor medius. The lower fibres are blended with those of the œsophagus, into which tube they detrude the food.

But the food, instead of thus descending from the commencement of the pharynx along its channel, might by the pressure of the upper constrictor, be forced back into the mouth, upwards into the nose, or downward into the larnyx, but for three especial contrivances.

The regurgitation of food into the mouth is partly hindered by the pressure of the tongue; but in addition the aperture leading from the pharynx into the anterior fauces is temporarily narrowed. On drawing out the tongue you may observe what is called the *soft palate*, a thick flexible substance of the breadth of the bony palate, an inch in depth, with a floating margin behind, prolonged centrally into the *uvula*, and laterally by an anterior and posterior fold or arch of membrane to either side of the tongue. The *tonsil* is a mucous gland situated between the two arches. The AZYGOS UVULÆ is the name given to a thin fasciculus of fibres found within the mucous surface of the uvula: the arches of the palate are projections formed by curved fasciculi of muscular fibres: those in the anterior arch ascending from the side of the tongue to the palate are called the CONSTRICTOR ISTHMI FAUCIUM; those in the posterior ascending from the pharynx to the palate are called the PALATO-PHARYNGEUS. When the tongue is pressed down with a spoon in examining a sore throat, you may observe, during the spasm usually

brought on by this irritant, the effect of the preceding muscles in diminishing the aperture between the anterior and posterior fauces.

To prevent the food passing into the nostrils, the soft palate is raised so as to close their posterior aperture, and rendered tense by another contrivance.

Dissect away the origins of the two pterygoïd muscles, you may observe a cartilaginous tube leading from the petrous portion of the temporal bone obliquely downwards and forwards to the posterior fauces, upon the lateral surface of which it opens. This is the termination of the EUSTACHIAN TUBE. Below the tube, but adherent to it, is seen a flat fasciculus of muscular fibres, which descend parallel to it; above the tube a narrow muscle of mixed flesh and tendon descends. Each of these muscles *arises* from the extremity of the petrous bone, and is of the breadth of half an inch; the lower is called the LEVATOR PALATI MOLLIS; it is *inserted* directly into the soft palate, and in its action raises it. That above is called the CIRCUMFLEXUS PALATI: its tendon plays round the hamular process of the internal pterygoïd plate of the sphenoïd bone, and is thence reflected inwards and backwards previously to its *insertion* into the soft palate. The *use* of this muscle is thus the reverse of the preceding. The circumflexus palati tends to depress the soft palate, and acting in concert with the levator palati mollis, gives adequate tension to the soft palate to prevent the passage of the food into the cavities of the nostrils.

Now lay open the pharynx to examine the aperture of the larynx: its canal is termed the *glottis*: an oval cartilage, called the *epiglottis*, attached to the thyreoïd below, is held vertically by a reflexion of membrane

against the base of the tongue: in swallowing, this cartilage is carried down by the food over the aperture of the glottis.

From the edges of the epiglottis folds of membrane, one on each side, pass to two pyramidal cartilages, called *arytænoïd*, which are nearly half an inch in height, and are articulated to the upper and posterior margin of the cricoïd cartilage. These folds are called the lips of the glottis ; they inclose an oval aperture; on looking down which the wall of either side appears at first prominent, then hollowed into an oblong sac, the inner margin of which forms a second projection parallel to the first, but sharper and more abrupt. The two projections on either side are termed the *ligamenta glottidis ;* the *ligamentum inferius* on each side is sometimes termed the chorda vocalis. The *chordæ vocales* meet anteriorly, they are at some distance behind, where the base of the triangular opening is formed by the flesh which passes transversely across to unite the two arytænoïd cartilages. The triangular aperture is called the *rima glottidis ;* the fossa on either side between the superior and inferior ligaments is called the *sacculus laryngis*.

Now dissect off the membrane of the pharynx, which covers the posterior surface of the larynx. Some glandular substance, the *arytænoïd gland*, is found between this membrane and the upper part of the arytænoïd cartilages, and various small muscles are exposed which move these cartilages.

The ARYTÆNOÏDEI OBLIQUI are thin fasciculi, which run from the side of the epiglottis to the tip of the arytenoïd cartilage of the same side, and are then

inclined to the inferior and outer corners of the opposite arytænoïd.

The ARYTÆNOÏDEUS TRANSVERSUS consists of a thick stratum of fibres, which runs transversely from the outer and posterior edge of one arytænoïd cartilage to the corresponding edge of the opposite.

The *use* of these three muscles is to close the aperture of the glottis: with the following muscles they constitute the mechanism by which the food is prevented entering the windpipe, and are sufficient for this purpose, when the epiglottis has been lost.

The remaining muscles are especially employed in the formation of vocal sounds.

The CRICO-ARYTÆNOÏDEI-POSTICI *rise* one from each of the two fossæ into which the posterior surface of the cricoïd cartilage is hollowed; each is *inserted* into the outer, lower, and posterior corner of the cricoïd cartilage of the same side: it is *used* to carry away the arytænoïd cartilage from its fellow: and thus to enlarge the rima glottidis.

The CRICO-ARYTÆNOÏDEUS LATERALIS rises from the side of the cricoïd cartilage, and ascends to be *inserted* into the lower and outer margin of the arytænoïd cartilage: its *use* is nearly similar to that of the preceding.

On cutting away the two posterior thirds of the thyreoïd cartilage on either side the THYREO-ARYTÆNOÏDEUS is seen; the fibres of which pass from the centre of the thyreoïd cartilage obliquely backwards and outwards to the anterior margin of the arytænoid cartilage of either side, and by their projection contribute to produce the chordlike appearance of the ligaments of the glottis.

It is observed in animals examined during life, that when the rima glottidis is narrowed, and the chordæ vocales are brought into apposition anteriorly, the notes of the voice are acute: at the same time it is found that the larynx is raised. When the contrary changes are produced the notes of the voice are grave.

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§ VIII. OF THE MUSCLES OF THE BACK.

Divide the skin from the occiput to the os coccygis in the median plane, and transversely from the spine of the scapula to the vertebræ: dissect the subjacent muscular and tendinous surface upward and downward from the transverse incision. Above, an extensive triangular muscle is exposed, the base of which extends from the occiput to the loins, its apex to the sterno-scapular joint: it is called the trapezius, or cucullaris. Its lower angle covers part of a broad muscle which occupies the remaining surface of the back and loins, and is called the latissimus dorsi.

Origin of the TRAPEZIUS: from the inner part of the superior transverse ridge of the occipital bone, from the ligamentum nuchæ, which extends between the sixth cervical vertebra and the tubercle of the occiput, from the spines of the sixth and seventh cervical, and of all the dorsal vertebræ: its origin is tendinous from the lowest vertebræ of the neck and from the uppermost and lowest of the back.

Insertion: The upper fibres, which are thin, descend obliquely outwards, the middle fibres run transversely, the lower ascend obliquely: the muscle is inserted into

the outer third of the superior margin of the clavicle, and into the upper margin of the spine of the scapula.

Use: All the fibres of the trapezius concur in drawing the scapula and clavicle backwards and inwards: the uppermost raise the scapula: the lowest tend to depress it, but acting in concert with the upper fibres, tend to elevate the glenoïd cavity and to direct its axis upward and outward.

Origin and *insertion* of the LATISSIMUS DORSI: this muscle *rises*, tendinous, from the spinous processes of the seven lower dorsal vertebræ, of all the lumbar vertebræ, and of the sacrum and os coccygis, and from the margin of the tuberosity of the ilium, fleshy and tendinous, from more than the posterior third of its crest. The beginning of its muscular fibres describes a line concave outwards. These ascend obliquely over the side of the chest, and are attached to the sides of the three lower ribs, are then collected into a thick band four inches in depth, which partly passes over the lower angle of the scapula, to which it is sometimes attached; and are finally so disposed, that the lower fasciculi ascend before the upper to take hold of a strong flat tendon, which is *inserted* into the posterior or internal margin of the bicipital groove of the humerus.

Use: To carry the humerus downward, backward, and inward, and to depress the lower ribs. At the interval between the two preceding muscles the fasciculi of a second layer are seen descending obliquely to the lower angle of the scapula: in order to expose this layer divide the trapezius an inch from and parallel to the spine, and dissect each way. A rhomboïdal mass of flesh is seen to extend from the vertebræ to the scapula.

The part *inserted* into the base of the scapula below its spine, *arises* from the spines of the five uppermost dorsal vertebræ, and is termed the RHOMBOÏDEUS MAJOR.

The part *inserted* into the base of the scapula for the breadth of the root of its spine, *arises* from the spinous processes of the two lowest cervical vertebræ and of the first dorsal, and is called the RHOMBOÏDEUS MINOR.

The use of these two muscles is to carry the scapula backward, inward, and upward: if the fibres act unequally, the lower more vigorously than the upper, the axis of the glenoïd cavity is directed downward.

The portion of the base of the scapula above its spine is occupied by the *insertion* of another muscle, the LEVATOR SCAPULÆ, which *arises* from the transverse processes of the five superior cervical vertebræ: its name expresses its *use*.

The three preceding muscles form a second partial layer in the dissection of the back; they are the last of nine, which attach the bones of the arm and shoulder to the trunk: the whole may be easily recollected in the following association, which gives indeed an inadequate notion of their action, to be corrected by reference to what has been said of their individual uses: it may be loosely stated, that the trapezius, levator scapulæ, and serratus magnus combine to raise the shoulder and to direct the glenoïd cavity upwards as in the preparation for a downward blow. That the pectoralis major, minor, and subclavius, combine to carry the arm downward, forward, and inward, and that the latissimus dorsi, and the two rhomboïdei may combine to carry the arm downward, backward, and inward.

Divide the rhomboïdei and the latissimus dorsi transversely: on carefully separating them from the layer beneath, two respiratory muscles are seen of very similar appearance but contrasted situation, called serrati postici.

The SERRATUS POSTICUS SUPERIOR *rises* tendinous from the spinous processes of the three lowest cervical and of the two uppermost dorsal vertebræ; it is inserted fleshy into the second, third, fourth, and fifth ribs, which it is *used* to raise.

THE SERRATUS POSTICUS INFERIOR *rises* tendinous from the spinous processes of the three lower dorsal, and of the three upper lumbar vertebræ; its thin tendon is scarcely separable from that of the latissimus dorsi, which covers it.

The *fascia lumborum* is now seen to be an aponeurotic production of the tendon of the serratus posticus superior, or of the tendon common to that muscle and to the latissimus dorsi.

The serratus posticus inferior is *inserted* fleshy into the four lower ribs just within the adhesions of the latissimus dorsi to the chest: it is *used* to depress the lower ribs.

The two serrati postici form a third partial layer: on dividing the tendon of the uppermost a considerable breadth of muscle is seen to ascend obliquely from the five lowest spines of the neck, and the four uppermost of the back to the transverse processes of the five upper vertebræ of the neck, to the superior transverse ridge of the occipital bone and the adjoining ridge upon the temporal. The portion connected with the head, which *arises* from the seven uppermost of the spinous processes mentioned, is called the SPLENIUS CAPITIS: the lower

portion, the SPLENIUS COLLI: the splenii rotate and incline the head and neck to the same side.

When the splenii are removed above, and the serratus posticus inferior below, a complex stratum of seven muscles may be dissected, extending from the sacrum to the occiput, covered in the dorsal region by an aponeurosis analogous to the fascia lumborum.

When this aponeurosis is removed, a separation may readily be distinguished in the loins between a thin muscle running along the spinous processes of the vertebræ and great part tendinous, and an external solid mass of muscular substance covered below by an uniform layer of tendon. The former is the SPINALIS DORSI, which *rises* from the sides of the spinous processes of the three upper vertebræ of the loins and of the two lower in the back, and is *inserted* into the spinous processes of the nine upper dorsal: it assists in sustaining the vertebral column.

The external greater mass of flesh arises from the posterior surface of the sacrum and os coccygis, from the fore part of the tuberosity of the ilium, and from the spinous and transverse processes of the lumbar vertebræ, thus forming the common origin of a larger inner muscle, the LONGISSIMUS DORSI, and an outer of less bulk, the SACROLUMBALIS.

The division between the two takes place at the lower margin of the chest; the former is *inserted* by twelve tendinous slips to the apices of the transverse processes of the dorsal vertebræ, and by twelve others to the ribs immediately beyond: the latter by twelve tendons into the angles of the twelve ribs; on everting its insertion other twelve fleshy and tendinous slips are seen to ascend one from each rib and within the former

to join the tapering body of the muscle; these are termed the musculi accessorii ad sacrolumbalem.

The longissimus dorsi and sacrolumbalis support the trunk, and in as far as they are inserted into the ribs, may be employed as muscles of expiration.

The five or six uppermost of the musculi accessorii are again enumerated as the *origin* of the outer of the four muscles of this layer which are found in the cervical region: the muscle thus constituted is the CERVICALIS DESCENDENS: it is *inserted* tendinous into the transverse processes of the fifth, sixth, and seventh cervical vertebræ.

On raising this, a second equally thin but of more extensive attachments, the TRANSVERSALIS COLLI may be distinguished; it rises from the transverse processes of the five upper dorsal vertebræ, and is inserted into the transverse processes of the five upper cervical vertebræ. The use of the two latter muscles is to incline and rotate the spine towards the same side. A third thin muscle follows, the TRACHELO-MASTOÏDEUS, which *rises* from the transverse processes of the three uppermost vertebræ of the back and of the five lowest in the neck, and is *inserted* into the temporal bone and occipital bones within the mastoïd process of the former: its action is similar to those of the former, but tells upon the head in addition and primarily.

The last and innermost of this layer is thoroughly exposed when the trachelo-mastoïdeus is removed: it is termed the COMPLEXUS: it rises from the transverse processes of the five lower cervical and of the seven upper dorsal vertebræ, likewise from the spinous process of the first dorsal, and is inserted into the occipital bone

between its transverse ridges: it is *used* to incline and rotate the head towards the same side.

Detach the complexus at its insertion and evert it, dissecting the layer it covers, the upper part of which consists of the recti and obliqui capitis postici. The RECTUS POSTICUS MAJOR *rises* from the spinous process of the dentata: its fibres spread, as it ascends obliquely outwards, and are *inserted* into the occipital bone.

The RECTUS POSTICUS MINOR *rises* from the spinous process of the atlas, is smaller than, but in every other respect similar to the latter, and is inserted before it, close upon the margin of the foramen magnum.

The OBLIQUUS CAPITIS SUPERIOR *rises* from the transverse process of the atlas, and after ascending obliquely inwards and backwards is *inserted* into the inferior transverse ridge of the occipital bone: the three last described muscles assist in keeping the head from falling forwards.

The OBLIQUUS CAPITIS INFERIOR *rises* from the spinous process of the dentata, and is *inserted* into the transverse process of the atlas: it is *used* to rotate the atlas to the same side.

The mass of oblique fibres, which forms the lower part of this layer of muscle, are, above, the SPINALIS COLLI, which *rises* from the spinous processes of the six lower vertebræ of the neck, and of the four upper of the back, and is *inserted* into the transverse processes of the six uppermost dorsal vertebræ: below, the SEMISPINALIS DORSI, which *rises* from the spinous processes of the fifth, sixth, seventh, eighth and ninth vertebræ of the back, and is *inserted* into the transverse processes of the seventh, eighth, ninth, tenth, and eleventh dorsal ver-

tebræ: the use of these muscles is to support the trunk, acting with their fellows: either acting singly inclines the trunk in addition towards the same side.

On cutting through the two preceding muscles, another layer of muscular and tendinous substance is found filling up the remainder of the angular hollow between the spinous and transverse processes of the vertebræ; this layer is termed the MULTIFIDUS SPINÆ, and extends from the dentata to the sacrum; its fasciculi are disposed parallel to each other; the uppermost fasciculus extends from the spinous process of the dentata to the transverse process of the fourth cervical vertebra, and so on in succession, till the last reaches the ilium: its *use* appears to be similar to that of the preceding.

Finally, the bifurcated spinous processes of the vertebræ of the neck, exclusive of the first and second, are connected together by two sets of vertical muscular slips, one from each apex to that below, which are termed MUSCULI INTERSPINALES. A similar double range of delicate muscles connects together the adjoining apices of the transverse processes of all the cervical vertebræ: these are termed MUSCULI INTERTRANSVERSALES ANTERIORES and POSTERIORES: muscles similar to these, only much slighter, are to be found in the back and in the loins. Lastly, from the transverse process of each dorsal vertebra a small triangular muscle descends to the upper margin of the rib below, which forms the series called LEVATORES COSTARUM.

Now turning the trunk upon the side, you notice that immediately before the cervicalis descendens three cylindrical muscles ascend from the upper ribs to the transverse processes of the cervical vertebræ

The muscle adjoining the cervicalis descendens is called the SCALENUS POSTICUS: it *rises* from the outer part of the second rib, and is *inserted* into the transverse processes of the fifth and sixth cervical vertebræ.

The next in order is termed the SCALENUS MEDIUS: it is the largest of the three, *rises* from the posterior tubercle of the first rib, and is *inserted* into the transverse processes of the seven cervical vertebræ.

The foremost is called the SCALENUS ANTICUS: it *rises* from the anterior tubercle of the first rib, and is *inserted* into the transverse processes of the three lower cervical vertebræ. These three muscles either incline the vertebræ of the neck to the same side, or raise the ribs to which they are individually attached.

A muscle seems to rise from the line along which the scalenus anticus is inserted: this muscle termed the RECTUS CAPITIS ANTICUS MAJOR *rises* from the transverse processes of the five middle cervical vertebræ, and is *inserted* into the basilar process of the occipital bone.

The RECTUS CAPITIS ANTICUS MINOR is exposed by removing the upper portion of the preceding muscle; it *rises* from the fore part of the atlas, and is *inserted* into the anterior margin of the foramen magnum: the recti antici bend the head forward.

The RECTUS CAPITIS LATERALIS rises from the transverse process of the atlas, and is inserted into the surface of the occipital bone without its condyle: it inclines the head laterally upon the atlas.

A long muscle yet remains upon the fore part of the vertebral column, the attachments of which are very intricate: in appearance it resembles the rectus capitis anticus major, internally to which its upper portion is situated. It is called the LONGUS COLLI. It *rises*

from the bodies of the three upper dorsal and of the two lower cervical vertebræ, from the transverse processes again of the five middle cervical vertebræ, and is *inserted* into the bodies of the five upper vertebræ of the neck: in its action it bends the neck forward.

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§ IX. OF THE MUSCLES OF THE UPPER EXTREMITY.

On the division of nine muscles already described, the upper extremity becomes separated from the trunk of the body. By means of the combined action of these nine muscles, the scapula, held out and sustained by its clavicular attachment to the sternum, is rolled upon the ribs, and its articular surface directed obliquely, either upwards, forwards, downwards, or backwards.

The muscles next to be dissected are those, which conduce to the play of the humerus upon the glenoïd cavity of the scapula, or to the more limited movements of the radius and ulna upon the humerus. Place a block under the axilla of the separated arm, so that the shoulder joint may be fully bent; make a longitudinal incision from the extremity of the acromion half way down the outside of the arm, and dissect the flap of skin either way.

The shoulder appears covered by a triangular production of the trapezius. The DELTOÏD, as this muscle is called, *arises* tendinous and fleshy from the margins of bone opposite to those, which give insertion to the trapezius; that is to say, from the inferior margin of the spine of the scapula, from the outer margin of the acromion, and from the outer third of the anterior margin of

the clavicle: the three portions of the muscle thus enumerated are separated from each other by cellular substance, and individually appear composed of several distinct and coarse fasciculi.

The lower part of the deltoïd, which is internally tendinous but outwardly fleshy, and coheres anteriorly with the tendon of the pectoralis major, is *inserted* into a tubercle situated half way down the outside of the humerus. When all the parts of the deltoïd are in action they concur in raising the humerus; the anterior part with the middle would tend to carry the humerus forward as well as outward and upward; the posterior with the middle part, backward as well as upward and outward.

The fossa of the scapula is occupied by the *origin* of the SUBSCAPULARIS, the fibres of which are arranged by three slips of intermuscular tendon connected with three ridges upon the fossa into four large fasciculi, which all converge towards the margin of the glenoïd cavity: they are in part separated from the capsular ligament of the joint by a bursa mucosa, in part adhere to it: they are *inserted* into the lesser tubercle of the humerus. All the fibres of the subscapularis concur in rotating the humerus inwards; the upper three-fifths of its fibres are *used* to carry the humerus upwards and outwards; those below to depress it.

The insertion of the tendon of the latissimus dorsi into the inner margin of the bicipital groove is now more distinctly seen; this tendon is observed to adhere (a bursa mucosa intervening) to a thick muscle called the TERES MAJOR, which *rises* from the square dorsal surface of the lower angle of the scapula, and is *inserted* behind the tendon of the latissimus dorsi; and being

broader than the latter, its upper margin is seen from the fore part above the flat tendon already described. The teres major is *used* to carry the humerus, if previously raised, downward towards the side, and subsequently backward, upward, and inward. The subscapularis, teres major, and latissimus dorsi form the posterior wall of the axilla.

The remainder of the dorsum of the scapula is clothed by three muscles, of which the two lower are invested with an aponeurosis derived from the trapezius and from the posterior edge of the deltoïd. The upper again is covered by a thinner aponeurosis, occupies and *rises* from the fossa supraspinata, and is termed the SUPRASPINATUS; a bursa mucosa is interposed between it and the deltoïd ligament of the scapula; the second occupies and *rises* from the fossa infraspinata, and is termed the INFRASPINATUS; the lowest, called the TERES MINOR, separated from the second by an intermuscular ligament, *rises* from the flattened dorsal margin of the outer costa of the scapula.

These three muscles are *inserted* into the greater tubercle of the humerus in succession; the supraspinatus to its anterior surface; the infraspinatus to its middle or outer surface; the teres minor to its posterior surface; the latter is additionally *inserted* tendinous and fleshy into the humerus below the greater tubercle.

These muscles concur in rotating the humerus outwards; but whereas the upper two-thirds of the mass tend to carry the humerus upward and outward, the lower third, including the teres minor and the lower part of the infraspinatus, tends to depress the arm.

A distinct fascia invests the muscles covering the humerus: those upon the fore part are the coraco-bra-

chialis, the biceps flexor cubiti, and the brachialis internus, the two first of which form the outer wall of the cavity of the axilla.

The CORACO-BRACHIALIS *rises* from the extremity of the coracoïd process of the scapula, is of no great thickness, and is *inserted* into the middle sixth of the inner margin of the humerus: it is *used* to carry the humerus upwards, forwards, and inwards.

The BICEPS FLEXOR CUBITI *rises* by a short or inner head, in common with the preceding muscle, from the extremity of the coracoïd process of the scapula; by a long head from the upper margin of the glenoïd cavity of the scapula. The second origin is by means of a round tendon which passes through the capsular ligament of the shoulder-joint over the head of the humerus. The grain of the biceps is remarkably delicate; its two portions, which apparently unite where they meet, are readily separable to near the elbow-joint, where the lower tendon of the muscle begins: this is *inserted* in two fashions: internally it is produced into a strong aponeurosis covering the fore part of the fore-arm; externally it dips down before the elbow-joint to be attached to the posterior margin of the tubercle of the radius.

The biceps flexor cubiti carries the humerus forward, upward, and inward, bends the elbow-joint, and supinates the radius.

The radius is so articulated to the ulna, that it may either lie in the same plane with that bone, when the fore-arm is said to be in supination; or on the other hand, be crossed before the ulna, the head of which has a convex margin round which the radius moves:

in the latter case, the fore-arm is said to be in pronation.

The BRACHIALIS INTERNUS is exposed on removing the biceps: it covers the fore part of the humerus; its upper fibres are attached along a semilunar line, which encircles the insertion of the deltoïd; they are thence inclined slightly from without inwards; other fibres continue to rise from the whole of the fore part of the bone, and from the intermuscular ligament, which ascends from the inner condyle. The brachialis internus is *inserted* into the base of the coronoïd process of the ulna, and its *use* is that of a simple flexor of the elbow-joint.

The back part of the humerus is clothed by the TRICEPS EXTENSOR CUBITI, which *arises*, 1, by an outer portion, or short head, from the external margin of the humerus and the adjacent dorsal surface of the bone; 2dly, by a middle portion or long head from the neck of the scapula, and which emerges between the teres minor and major; and 3dly, by an inner portion sometimes called the BRACHIALIS EXTERNUS, from the inner margin and adjoining posterior surface of the bone.

The three portions coalesce about the middle of the arm, a broad tendon is formed superficially, and the muscle is inserted tendinous and fleshy into the olecranon and the aponeurosis covering the back of the fore-arm. The triceps extensor cubiti is *used* to extend the elbow-joint; its long head tends likewise to carry the humerus upward, backward, and inward.

The flesh of the fore-arm lies in two masses, one disposed upon the inner and fore part, the other upon the outer and back part: the former covered by the

aponeurosis of the biceps, the latter by that of the triceps; the former consisting principally of flexors of the wrist and fingers and of pronators of the fore-arm, the latter of extensors of the wrist and fingers and of supinators of the fore-arm; the anterior separation of the two masses is marked above by the fossa, into which the tendon of the biceps dips, the posterior by the subcutaneous margin of the ulna. The aponeurosis, which covers either mass, is readily separable below, but with difficulty above, where it gives attachment to the subjacent muscles. On the outer and upper margin of the arm the aponeurosis degenerates into a thin fascia.

Immediately behind the wrist-joint, and before the ancle-joint, the aponeurosis of the limb is considerably strengthened by cross fibres which form *annular ligaments*, and confine the extensor tendons: what is called the *anterior annular ligament* of the wrist is of a like nature, but is found at the lower part of the fore-arm, *above* the wrist-joint.

The muscles which are attached to either condyle of the humerus seem to have a very small extent of adhesion to the humerus; but as they are nearly all united together by intermuscular tendons near their origin, the attachments of all contribute to sustain the force of any single muscle. It is convenient to dissect the muscles of the two regions from either side of the tendon of the biceps; the extensors in succession outwards from this point, the flexors in a contrary direction; and again, as they lie in more than one layer, to describe them by layers.

The muscles clothing the radial edge and back part of the fore-arm are disposed in two layers. The first in the order proposed is the SUPINATOR RADII LON-

GUS, which *rises* by a considerable breadth of muscular fibre from the outer margin of the humerus; at some distance above the outer condyle, and is *inserted* by a long tendon into the root of the styloïd process of the radius: it is *used* to bend the elbow-joint, and to supinate the fore-arm.

2. The EXTENSOR CARPI RADIALIS LONGIOR is a muscle very similar in appearance to the last, and *rises* from the same edge of bone lower down; its long tendon passes under the posterior annular ligament of the wrist, and is inserted into the outer, upper, and back part of the metacarpal bone of the fore-finger.

3. The EXTENSOR CARPI RADIALIS BREVIOR rises from the extremity of the outer condyle, and in course and appearance resembles the last; it is inserted into the outer, upper, and back part of the second metacarpal bone. The two last muscles are *used* to bend the elbow-joint, to extend and supinate the wrist, and are abductors of the hand.

4. The EXTENSOR DIGITORUM COMMUNIS *rises* from the back part of the outer condyle and from the oblique ridge of the ulna, and is divided below the middle of the fore-arm into four tendons, one of which passes to either finger, to be *inserted* by a tendinous expansion into each of its three phalanges. Frequently, a separate fasciculus of this muscle sends a second tendon to the little finger, and is termed the EXTENSOR MINIMI DIGITI, or *auricularis*. The extensor communis digitorum, is *used* to extend and supinate the wrist, and to extend the joints of the fingers.

5. The EXTENSOR CARPI ULNARIS *rises* from the back of the outer condyle within the former, from the oblique ridge of the ulna, and subsequently from its

posterior margin to within a quarter of its length from the wrist. The tendon of this muscle is *inserted* into the upper, inner, and back part of the metacarpal bone of the little finger: its *use* is extension of the elbow and wrist, and adduction of the hand.

6. The ANCONEUS *rises* from the outer condyle beyond the last, and is inserted into the outside of the olecranon as low down as the oblique ridge of the ulna; its *use* is extension of the elbow-joint.

The preceding six muscles form the outer layer in this region, and the inner layer is found to consist of the following:

1. The SUPINATOR RADII BREVIS *rises* both from the outer condyle of the humerus and from the oblique ridge of the ulna below the extensor digitorum communis. Its fibres pass downwards, and forwards, and around the neck of the radius, so as to be *inserted* tendinous and fleshy into the upper three inches of its outer and anterior surface. This muscle is *used* to extend the elbow-joint, and to supinate the wrist.

2. The EXTENSOR PRIMI INTERNODII POLLICIS *rises* at the lower edge of the preceding muscle from the posterior surface of the radius, interosseous ligament, and ulna, for about two to three inches; its tendon is *inserted* into the upper, outer, and back part of the metacarpal bone of the thumb; its *use* is abduction of the thumb.

3. The EXTENSOR SECUNDI INTERNODII POLLICIS *rises* from the back part of the radius, and from the adjoining surface of the interosseous ligament below the preceding. Its tendon passes in the same sheath with that of the preceding muscle, beyond which it extends to be inserted into the back of the first phalanx of the

thumb. This muscle is *used* to extend the joint between the first phalanx and metacarpal bone of the thumb, and is an abductor of the thumb.

4. The EXTENSOR TERTII INTERNODII POLLICIS *rises* from the outer edge of the ulna and from the adjoining surface of the interosseous ligament. Its tendon runs in an oblique groove over the extremity of the radius, at an inch distance from that, which serves for the two last tendons. It is *inserted* into the back of the last phalanx of the thumb; it is an extensor of all the joints of the thumb and of the wrist.

5. The EXTENSOR PRIMI DIGITI, or INDICATOR. *rises* from the same parts immediately below the former. Its tendon passes obliquely to the phalanges of the fore finger, into all of which it is *inserted* by a thin expansion; its name denotes its *use*.

The muscles clothing the inner and fore part of the fore-arm are disposed in four layers. The first beginning from the tendon of the biceps, is the PRONATOR RADII TERES, which *arises* from the fore and upper part of the inner condyle, and is *inserted* chiefly tendinous into the middle sixth of the outer margin of the radius. Its *use* is flexion of the elbow-joint and pronation of the fore-arm.

2. The FLEXOR CARPI RADIALIS *rises* below and within the latter; its long tendon runs below the ligamentum carpi transversale, and through a groove in the trapezium to be *inserted* into the outer, upper, and fore part of the metacarpal bone of the fore finger. Its *use* is flexion of the elbow, pronation of the wrist, and abduction of the hand.

3. The PALMARIS LONGUS *rises* from the fore part of the inner condyle; its tendon, twice the length of

the muscular part, adheres to the ligamentum carpi transversale, and is then expanded over the palm of the hand forming a thick triangular fascia, called the *palmar fascia*, which extends as far as to the joints of the metacarpal bones and the phalanges of the fingers, and is blended with their ligamentous structure. The palmaris longus is sometimes wanting; its *use* is to give tension to the palmar fascia; so that when the hand grasps any hard substance, the nerves and arteries which it contains may be protected from injurious pressure. From the inner edge of the palmar fascia a few fibres run transversely to the skin at the margin of the hand, which are called the PALMARIS BREVIS, and in their action render the palm of the hand cupped.

4. The FLEXOR CARPI ULNARIS *rises* from the extremity of the inner condyle, and from the upper two-thirds of the posterior margin of the ulna. It is *inserted* tendinous and fleshy into the os pisiforme; its *use* is flexion of the elbow-joint and wrist, and adduction of the hand.

When the four muscles of the superficial layer are raised, one broad muscle is seen to form the second. The FLEXOR COMMUNIS DIGITORUM SUBLIMIS PERFORATUS *rises* from the inferior and fore part of the inner condyle, from the inner margin of the coronoïd process of the ulna, and from the oblique ridge of the radius. It is *inserted* by four tendons which pass behind the ligamentum carpi transversale, and are each finally split, into the fore and upper part of the second phalanx of each finger; its *use* is flexion of all the joints it passes before.

On cutting the preceding muscle across, the third layer is exposed, which consists of two muscles.

1. On the inside, the larger, the FLEXOR DIGITORUM COMMUNIS PROFUNDUS PERFORATUS, rises from the upper two-thirds of the fore and inner surfaces of the ulna from the adjoining surface of the interosseous ligament, and by a slip from the radius below the tubercle. This muscle divides, like the preceding, into four tendons, which pass behind the former, and finally each perforating one of the former series arrives at and is *inserted* into the fore and upper part of the third phalanx of each finger. Its *use* is flexion of all the joints, before which it passes. From the outside of each of the four tendons of the flexor profundus in the hand, a round and slender muscle termed a LUMBRICALIS arises, which passing along the outside of the first phalanx of each finger coheres with its surface, but is finally *inserted* into the upper and outer margin of each second phalanx. The lumbricales are abductors of the fingers.

2. The FLEXOR LONGUS POLLICIS *rises* by a thin slip from the lower and fore part of the inner condyle of the humerus, from the middle half of the anterior surface of the radius, and from the adjoining interosseous membrane; its tendon passes behind the ligamentum carpi transversale, between the two portions of the flexor brevis pollicis, and is inserted into the fore and upper part of the last phalanx of the thumb: the *use* of this muscle is to bend the joints, before which it passes, and to carry the thumb inwards.

On separating the two preceding muscles, a single muscle as a fourth layer is found remaining. The PRONATOR RADII QUADRATUS *rises* from the acute anterior margin of the ulna near the wrist joint, tendinous and fleshy; its fibres pass obliquely outwards and slightly downwards to occupy a similar breadth of the outer

edge and fore part of the radius: the name of the muscle denotes its *use*.

The palm of the hand may now be fully dissected; the cellular substance is easily raised from the muscles attached to the thumb and to the little finger, and their membranous partitions are readily seen.

The muscles of the thumb are, 1, the ABDUCTOR POLLICIS, which *rises* from the os naviculare and the ligamentum carpi transversale, and is *inserted* into the upper and outer part of the first phalanx: the name denotes its *use*: but the terms abduction and adduction, when applied to the muscles in the hand and foot, have reference to the centre of the hand, not to the median plane of the body: in this case it happens that the term is equally correct in either signification.

2. The FLEXOR BREVIS POLLICIS *rises* from the unciforme, magnum, and trapezium, and from the ligamentum carpi transversale, and is divided into two portions, which are *inserted* directly into the two ossa sesamoïdea, and by means of the adjoining capsular ligament into the fore and upper part of the first phalanx of the thumb: the *use* of this muscle is to bend the joint of the metacarpal bone of the thumb with the first phalanx, and to carry the thumb inwards.

3. The ADDUCTOR OSSIS METACARPI POLLICIS, or OPPONENS POLLICIS, *rises* from the trapezium and ligamentum carpi transversale, and is *inserted* into the whole fore and outer surface of the metacarpal bone of the thumb; it is *used* to carry the metacarpal bone of the thumb forward and inward.

4. The ADDUCTOR POLLICIS *rises* from the anterior edge of the metacarpal bone of the middle finger and from the fore part of the base of the metacarpal bone of

the ring finger, and is *inserted* into the upper and inner part of the first phalanx of the thumb.

The muscles of the little finger are, 1, the ABDUCTOR MINIMI DIGITI, which *rises* from the os pisiforme and ligamentum carpi transversale, and is *inserted* into the inner and upper margin of the first phalanx of the little finger: it carries the little finger forward, as well as from the ring finger.

2. The FLEXOR BREVIS MINIMI DIGITI *arises*, partly covered by the preceding, from the os unciforme and transverse ligament of the wrist, and is *inserted* into the fore and upper margin of the first phalanx of the little finger.

3. The ADDUCTOR OSSIS METACARPI MINIMI DIGITI *rises* from the os unciforme, and is inserted into the inner and fore part of the metacarpal bone of the little finger; in its action it carries the metacarpal bone forward and towards the thumb.

The remaining muscles may be readily understood in the following method, which differs from that in which they are commonly described. Reverse the hand, cut away the extensor tendons, and dissect the cellular substance from the muscles in the intervals of the metacarpal bones: you may notice four muscles strictly resembling each other, bicipital, *arising* each from the opposite surfaces of adjoining metacarpal bones. Of these the two on either side of the middle metacarpal bone are *inserted* one to the inside the other to the outside of the base of the first phalanx of the middle finger. Of the two which remain, the inner is *inserted* into the inner edge of the base of the first phalanx of the ring finger: the outer into the outside of the base of the first phalanx of the fore finger. Their

uses are obvious. They may be enumerated as *four* BICIPITES or INTEROSSEI EXTERNI. The description of these muscles is usually obscured by describing the three innermost only as bicipites; and dividing the external into two, calling that portion nearest the fore finger the *prior indicis*, that more remote the *abductor indicis*.

The prior indicis again is said to be the outermost of *four* INTEROSSEI INTERNI or ANTERIORES: of which description of muscles, on the exclusion of the prior indicis, you may dissect and reckon three: one *rising* from the outside of the metacarpal bone of the little finger and *inserted* into the outside of the base of its first phalanx: a second similarly disposed in regard to the ring finger: and a third *arising* from the inside of the metacarpal bone of the fore finger, and *inserted* into the inside of the base of its first phalanx.

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§ X. DISSECTION OF THE MUSCLES OF THE PERINEUM AND OF THE PELVIC VISCERA IN A MALE BODY.

Place the body in the position for lithotomy: introduce a sound into the bladder, and let the rectum be distended with horse hair. Make a semicircular incision through the skin on either side from the os coccygis to the symphysis of the pubis, and dissect off the skin. The subjacent cellular texture, which above the rectum is an inch and a half in thickness, is called the *fascia superficialis perinei*.

On dissecting this fascia from the verge of the anus a muscle called the SPHINCTER EXTERNUS ANI is seen to arise fleshy or by elastic ligament from the extremity of the os coccygis to surround the orifice of the rectum, and then to be continued forwards in the median plane as a triangular slip G [Plate 1.] Above and centrally the surface exposed is that of the *spongy body* of the *urethra*, dilated into what is termed the *bulb* E, as it bends under the arch of the pubes towards the bladder: the lower three inches of the bulb are clothed by the ACCELERATOR URINÆ, the fibres of which *rise* from a median membranous line and pass obliquely outward and forward; the posterior fibres have an attachment to the ligament of Camper: the anterior are *inserted* into the corpora cavernosa penis. The TRANSVERSUS PERINEI is a muscle sometimes wanting, sometimes oblique, sometimes transverse in its course, which *rises* from the inside of the tuberosity of the ischium, and is *inserted* into the accelerator urinæ half an inch from its termination backward: the triangular portion of the sphincter externus ani is inserted into the under surface of the accelerator urinæ at the same part. The transversi and the triangular portion of the sphincter probably tend to dilate the bulb, which the accelerator urinæ tends to compress.

On either side of the perineum the crus penis F, surrounded by a thin layer of muscle called the ERECTOR PENIS, is attached to the inner and fore part of the tuberosity of the ischium, whence it is inclined obliquely forwards, upwards, and inwards, to meet its fellow behind the bulb, after which the name of the part is changed to *corpus cavernosum*. Thus the penis is composed of three parts, which are in structure cel-

lular. Above are placed the corpora cavernosa of a denser ligamentous texture, which are suspended to the symphysis of the pubes by the *ligamentum superius penis*, and below, the *corpus spongiosum urethræ* containing the mucous canal of the urethra.

On examining the surface exposed between the bulb and the crus penis on either side, you may observe at the upper part a very strong ligament called the *ligamentum triangulare urethræ*, or *ligament* of *Camper*, a section of which close upon its origin is represented at the letter C in the first plate.

The ligamentum triangulare *rises* from the inner margin of the arch of the pubes for an inch and a half on either side of the symphysis; whence the ligamentous fibres converge, those below ascending slightly so as to inclose, fix, and sustain the urethra, which perforates the ligamentum triangulare immediately above its lower margin. On exposing the surface of the rectum to the depth of the ligamentum triangulare, the bowel appears covered by muscular fibres H, parallel to those of the sphincter externus ani: these are the lower fasciculi of the LEVATOR ANI, which take an origin from the fore and under part of the ligament of Camper.

You may now consider the parts dissected in reference to the introduction of instruments into the bladder through the urethra or perineum.

1. The urethra is naturally curved anteriorly to the ligament of Camper in consequence of the attachment of the ligamentum superius penis: a metal sound or catheter should be provided with a similar curve, though the parts yield sufficiently to allow of the introduction of a straight instrument. Take a common sound and pass it down the urethra, with the handle directed

laterally for convenience, till the point of the instrument reaches the ligament of Camper, then bring the handle up to the median plane of the body, and continue to urge the sound forward; the instrument is in all probability abruptly stopt; you will find that its point has extended the dilatable bulb, and pushed the sac, which it has thus formed for itself, below and beyond the ligament of Camper. Withdraw the instrument two inches, and then press it forwards again, extending the penis at the same time upon the instrument, the handle of which you depress: the point of the sound is thus elevated, and instead of pushing the bulb below Camper's ligament, follows the true channel of the urethra above its lower margin. The obstruction thus explained and remedied is the common cause of failure in a first attempt to pass metallic instruments along a sound urethra into the bladder.

2. The division of the integuments in the lateral operation for the stone should begin an inch below the symphysis of the pubes on the left of the raphe and midway between that line and the arch of the pubes; the point of the knife may be thrust in at this level to the depth of an inch, so as to reach the lower margin of the ligament of Camper between the bulb and crus penis, the interval between which is to be fully exposed during this incision by an inclination of the staff towards the right side. The incision is to be continued obliquely downwards and outwards between the raphe of the perineum and the tuber ischii to the side of the anus: the lower part of the first incision is to divide the skin only. In deepening this incision, care is to be taken to avoid the rectum, which it is easy to press

downwards and towards the right side, by two fingers of the left hand introduced into the wound.

You may now resume the dissection, and expose the remaining course of the urethra and the viscera of the pelvis laterally.

Saw through the left os pubis parallel to and at a third of an inch from the symphysis: cut through the psoæ and iliacus internus opposite to the sacro-iliac synchondrosis: inflate the bladder slightly from the ureter. Press the bladder back from the pubes, you see from above the *ligamentum cervicis vesicæ* [marked B in the adjoined Plate] descending from either side of the symphysis of the pubes to the lower and fore part of the bladder; the ligament is thicker laterally than in the median plane. You may observe in addition, that a fascia passes from it over the side and fore part of the bladder called *fascia vesicalis*. Now press the bladder towards the right side; you may observe thus exposed upon the left another process of fascia reflected from the side and lower part of the bladder, and from the ligamentum cervicis vesicæ to the side of the pelvis upon which it ascends, taking strong hold of the spinous process of the ischium, and finally reaching and turning over the margin of the lesser basin, or becoming fascia iliaca. Through this fascia the muscles lining the lesser basin are indistinctly seen. A line whiter and more opaque than the rest of the fascial surface extends from the spinous process of the ischium to the side of the symphysis; cut through the fascia below and parallel to this line and detach it from the spinous process of the ischium: on dissecting it downwards the fibres of the *inner portion* of the LEVATOR ANI are seen from within; which *rises* from the pubes

on either side of the symphysis, from the white fascial line just described, from the spinous process of the ischium, and from the lowest bone of the sacrum, from which circular origin the muscular fibres descend funnel-like to close in upon and support the rectum.

Detach the levator ani from its origin on the left side: a layer of fascia parallel to that which invested it within is seen to have been interposed on its outside between its substance and the obturator internus, like the former strongly attached to the spinous process of the ischium; and you may observe that the union of these two fasciæ formed the white line already alluded to, and that thus the two are to be regarded as continuous above with the fascia iliaca. To find the anterior connexions of this external layer of fascia, you are now to begin to separate the left limb, gradually forcing the sacro-iliac joint by means of pressure applied to the front of the ossa ilii on either side. As the sawed surfaces of the os pubis recede from each other, you notice that this outer fascia is a lateral prolongation of the ligament of Camper. Now cut every substance through close upon the left margin of the arch of the pubes, scraping the bone with the knife, rend through the sacro-iliac joint, and divide the remaining flesh and integument. You have the view represented in the adjoined Plate, or may by a little further dissection produce it.

N is meant to represent the fascia derived from the ligamentum cervicis vesicæ and fascia vesicalis to the spinous process of the ischium: the handle of a knife is drawn as if interposed between the side of the bladder and the reflected fascia.

K, a continuation of the same over the rectum.

I, the inner portion of the levator ani.

C, the ligament of Camper, of great thickness, from the fore and under part of which H the *outer portion* of the levator ani arises, disposed in circular fasciculi, the highest investing the termination of the *inner portion*, with which they are soon after blended. The ligament of Camper is shorn close upon the bone so that the fascial prolongation of its outer and posterior margin, which lines the inner surface of the pelvis, is not shewn. The drawing represents in addition the internal pudic artery, which ascends behind the inner margin of the branch of the ischium, and is finally involved in the substance of Camper's ligament, in which it gives off its terminal branches. Observe that the bladder is egg-shaped, its narrow end foremost and uppermost. That nearly three-fifths of its surface behind and laterally are covered by peritoneum. That its anterior surface rests against the pubes, or when distended, against the pubes and the linea alba the recti and the transversi. That it is held forward by a triple ligament from its summit, of which one cellular chord is in the median plane, and two join this laterally in their ascent to the umbilicus, the central being what was the urachus of the fætus or tube leading from the bladder to the navel, the two lateral cellular chords (Q) being the closed hypogastric arteries. That the outer layer of muscular fibres is longitudinal. That the vas deferens L passed down between the peritoneum and upper part of the bladder externally to the hypogastric artery.

You have next to expose that part of the urethra which is interposed between the ligament of Camper and the bladder. Cut away the pubic origin of the inner

portion of the levator ani: you notice that a fascia extends from the ligament of Camper to the ligamentum cervicis vesicæ: by dividing this fascia longitudinally, you open the chamber in which the remaining part of the urethra is lodged. A sound should now be introduced into the bladder to show the course of the urethra, which is placed at about an inch distance from the symphysis of the pubes. The tube for nearly an inch behind the ligament of Camper is membranous, and is called the *membranous portion* of the urethra. The chamber in which it is contained, is principally occupied by the plexus of veins, which return the blood from the penis: in addition, in many bodies, fibres like muscular fibres, are found to descend from the symphysis and surround and sling the urethra at this part: the late Mr. Wilson discovered these, and described them as forming a COMPRESSOR URETHRÆ; and the very excellent representation of their appearance, which Mr. Wilson had engraved*, renders it quite unnecessary to give a drawing of the stage of the dissection I am now describing. The *glands* of *Cowper* are two small glandular bodies of very variable magnitude: they are not unfrequently found of the size of small peas, situated just behind the ligament of Camper, one on either side of the beginning of the membranous portion of the urethra, and united below it by a narrow isthmus. The duct of either lateral portion runs for about four inches below the membrane of the urethra, opening at its under part. The oval body, of the size and shape of a small chestnut, interposed between the membranous

* I am informed by the Publishers of this work, that the plate I allude to is in their possession; and I am happy to avail myself of the opportunity offered to me of adjoining it to these pages.

portion of the urethra and the bladder, and through which the urinary canal finally passes, is the *prostate gland.* There is often an appearance of fibres covering the gland laterally extending from the symphysis of the pubes obliquely downward and backward; these have been termed the COMPRESSOR PROSTATÆ.

Let the bladder now be drawn to the left side so as to expose its inferior surface: dissect off the fascia vesicalis from the lower and fore part of the side of the bladder, with the plexus of veins as well as the artery and nerves which it contains at this part.

You thus reach the interval between the bladder and rectum at the fore part. On pressing down the latter you notice that the fascia which invests it laterally is further continued between the rectum and the bladder, but is more adherent to the rectum. You observe the under surface of the prostate gland, and two flattened oblong bodies, two inches in length by half an inch in breadth, which converging at an acute angle meet at the posterior part of the prostate. These are the *vesiculæ seminales;* on cutting into which their structure seems a series of cells containing a brownish serum; when more carefully examined they are found each to consist of a long tube folded and convoluted on itself; upon the inner edge of each vesicula seminalis the vas deferens is found, which was before seen on the side of the bladder. The vesiculæ seminales and vasa deferentia perforate the prostate, and open by one duct on either side upon the under surface of the urethra. A transverse fissure exists at the under surface of the prostate, where this perforation takes place. The part of the gland behind this perforation is the third

lobe of the prostate gland described by Sir Everard Home.

Observe that the ureter crosses the vas deferens on its outside and opens obliquely into the bladder, about two inches from the neck of the bladder, and from its fellow. That the divergence of the vasa deferentia may be felt by the finger introduced into the rectum: that the space between their union and the reflexion of the peritoneum is less than an inch longitudinally: this is the surface, which is penetrated, when the bladder is punctured through the rectum, and which has been divided for the extraction of a stone from the bladder, in cases where it has happened that the stone has been felt distinctly projecting into the rectum.

You may observe what must be the course of the remaining incision in lateral lithotomy. In the adjoined drawing the direction of the urethra is represented by the dotted outline of a sound introduced into the bladder. Whether the operation be performed with the gorget, the bistoire caché, or the knife, the next step is an incision into the membranous portion of the urethra; below, if the first named instrument be used; laterally, if the last; in the first case the staff should be grooved below, in the last laterally. The beak of the gorget is introduced into the groove of the staff, which the operator takes in his left hand, and then finally depressing its handle, with the right urges the gorget through what remains of the membranous portion of the urethra, through the prostate gland and neck of the bladder. The advantage of the gorget is its mechanical precision, and that it allows the staff to be held by the operator; its disadvantage, the insecu-

rity of its incision; for it has happened, that it has but pushed backward the prostate gland, extending the membranous portion of the urethra, leaving the operator under the erroneous impression of his having perforated the bladder; 2, that the prostate and bladder have been detached from the urethra by the pressure of the gorget, instead of having been divided; and 3, that the bladder has been twice divided by this instrument. The bistoire caché is introduced into the bladder closed, its blade then extended laterally, and in this state it is retracted. The advantage of this instrument is, that it cannot fail of dividing the neck of the bladder; its disadvantage, that it may possibly divide the trunk of the internal pudic artery. The knife, perhaps to be employed in preference to these instruments, should have a blade such as is represented in the adjoined plate, cutting only for the last inch, and with a beak or nib fitting it to glide along the lateral groove. When carrying such an instrument forward, you employ the fore finger of the left-hand to press the rectum downwards, and subsequently introduce it into the bladder as a guide for the forceps.

When the bladder has been cut into, it does not immediately contract, but lies collapsed; the sound is then to be withdrawn, and the forceps introduced closed, and in that state directed with method and precision to the various surfaces of the bladder, till the stone is felt; upon which the blades of the forceps are to be opened to enclose it, if possible, by its short diameter. In withdrawing the stone, if large, and with difficulty retracted through the wound, the handles of the forceps may be gently raised and depressed alternately, in order to facilitate its passage.

The bladder may be punctured through the perineum; for this purpose the trochar is to be introduced midway between the raphe and the branch of the ischium, and about an inch and an half below the symphysis of the pubes, and then urged forward parallel to the axis of the pelvis at this part.

The bladder may again be punctured above the pubes. This operation is simple when the upper part of the bladder rises from distention into the abdomen; the trochar may then be plunged through the linea alba immediately above the symphysis, with the point inclined downward and backward. When the bladder is felt above the pubes, this is probably the best mode of puncturing it. The bladder may finally be opened above the pubes for the extraction of a stone; this operation is perhaps to be practised, when the prostate gland is enlarged, or the stone of great size. The bladder, in this mode of lithotomy, should be moderately distended, if it be practicable, by the substitution of warm water for the urine; a sound should further be introduced into the bladder. After a longitudinal division of the integuments, make an opening through the linea alba at its attachment to the pubes. Introduce the fore finger of the left-hand, press back the peritoneum, and divide the linea alba for three inches with a bistory; divide some part of the origin of the rectus on either side, to give freedom to the opening. It will be easy, by means of the sound already introduced, to recognize the bladder: let the sound be advanced to the apex of the bladder, and an assistant press gently upwards the peritoneum and viscera. Introduce into the fore and upper part of the bladder a pointed scalpel, with the edge towards the pubes, and

divide immediately against the pubes the fore part of the bladder, so as to make an aperture an inch and an half in length. Introduce immediately the fore finger of the left-hand into the bladder, which it is possible may be held upward by the extremity of the sound, and then introduce a curved forceps with thin blades. At every period of this operation great care is required, in order to avoid lacerating the peritoneum, or detaching the bladder from its adhesion to the pubes.

To return to anatomical description. Lay open the bladder at its fore part. Observe its internal mucous surface and the reticular disposition of its inner layer of muscular fibres. The part containing the aperture of the urethra is called the *cervix vesicæ;* towards which, at its under part, two fasciculi converge, containing the oblique passage of the ureters. On tearing off the mucous membrane from the cervix vesicæ, in some cases there is an appearance of fibres disposed circularly round the orifice. Notice the depth of the bladder towards the rectum behind the cervix.

Now remove the penis and bladder from the pelvis, and slit open the urethra from above. You notice elevated striæ at the lower part of the neck of the bladder, converging forwards, and terminating in a nodule called *caput gallinaginis* or *veru montanum* distant three-fourths of an inch from the orifice of the bladder; for about half an inch more a slight ridge is prolonged forward from this elevation. A blind membranous sac called *foramen cæcum Morgagni*, exists at the fore and upper part of the caput gallinaginis, hemispherical, a quarter of an inch broad and deep when inflated. Two apertures are found, one on either side of this eminence, which are the openings of the com-

mon ducts of the vasa deferentia and vesiculæ seminales. Again, in the furrow formed on either side of the caput gallinaginis, a great number of small orifices is found, rendered distinct by squeezing the prostate gland, of which they are the excretory openings, when a thick whitish secretion exsudes: on squeezing the vesiculæ seminales, their brownish secretion appears at the single lateral orifice on either side.

The urethra is of various calibre, narrow at the aperture of the bladder, dilated in the prostate, dilatable at the membranous part, contracted just before it enters the spongy body, at which part the ligament of Camper confines it; dilated in the bulb, thence becoming narrower to four inches from the orifice; dilated just within the orifice, and again contracted at that part.

Its mucous membrane presents various little depressions, termed *lacunæ*, of which the largest, three or four in number, are disposed along its upper surface. On cutting through the penis, the urethra represents a transverse linear aperture a third of an inch long, and its mucous lining seems thrown into slight longitudinal folds.

One muscle remains within the pelvis, connected more or less with the functions of its viscera, and exposed now that these have been removed; namely, the COCCYGEUS, which *rises* from the fore part of the spine of the ischium by thin fasciculi, which cover the internal sacrosciatic ligament and are *inserted* into the side of the os coccygis: it contributes to support the os coccygis.

§ XI. OF THE MUSCLES OF THE LOWER EXTREMITY.

THE right extremity may now be separated from the upper part of the trunk at the interval between the third and fourth lumbar vertebræ. Let the detached limb be laid upon its fore part, with a block under the upper part of the thigh, in order that the hip-joint may be bent. It is convenient to begin with the dissection of the muscles of the hip, of which the first in order, as the outermost or uppermost, are the glutæi. Three large muscles of this name, which are employed in extending the hip-joint, form three layers of flesh interposed between the integuments of the hip and the ilium; each glutæus rises from the ilium, and is inserted into the back or outer part of the femur.

Make an incision through the integuments from the tuberosity of the ilium to the great trochanter of the os femoris; this incision will nearly correspond with the direction of the coarse fasciculi of the outer muscle.

1. *Origin* of the GLUTÆUS MAXIMUS. From the outside of the tuberosity of the ilium, from the side of the sacrum and os coccygis, and from the outer surface of the posterior sacro-sciatic ligament; the fibres pass obliquely downward and outward.

Insertion. By a flat tendon, which passes over the great trochanter, a bursa mucosa being interposed, into the upper half nearly of the linea aspera; an aponeurosis extends from the anterior margin of the muscle to the crest of the ilium, and the tendon is continuous at either margin with the fascia lata.

Use. Extension of the hip-joint, and abduction and rotation outwards of the thigh.

Divide the glutæus maximus transversely, and dissect it together with its aponeurosis from the next muscle, to some of the fibres of which the latter part gives attachment.

2. *Origin* of the GLUTÆUS MEDIUS. From all of the dorsum of the ilium included between the crest, tuberosity, and semilunar line: the fibres are arranged into an anterior smaller portion, and a posterior broader portion partly covered by the former.

Insertion. By a flat tendon into the posterior gibbous line of the great trochanter.

Use. Extension of the hip-joint, and abduction of the thigh; rotation outwards of the thigh by the posterior fasciculi, and rotation inwards by the anterior.

The insertion of the glutæus medius is not perfectly seen, till the muscle has been raised from its origin and dissected back, when a third muscle is at the same time displayed.

3. *Origin* of the GLUTÆUS MINIMUS. From the dorsum of the ilium below the semilunar line.

Insertion. Into the anterior gibbous line of the great trochanter.

Use. Extension of the hip joint, abduction and rotation inwards of the thigh: but it is to be observed, that the foremost fasciculi of this muscle are flexors of the hip-joint, and the posterior again rotators of the thigh-bone outwards.

The next series of muscles to be dissected comprises six, which rotate the thigh outwards; the four first are in addition abductors, the two last adductors of the thigh. Of these six muscles, five are now exposed wholly or partially, which form a flat mass of muscular and tendinous substance, the direction of which is

above, obliquely, below, transversely outwards, from the sciatic notch, the spinous process, and tuberosity of the ischium towards the digital fossa and great trochanter.

1. The PYRIFORMIS is the tapering muscle, which emerges at the sacro-sciatic notch from an *origin* upon the fore part of the three middle bones of the sacrum, descends parallel to the posterior margin of the glutæus minimus, and is *inserted* by a round tendon into the middle of the upper margin of the great trochanter.

Wholly below, or in part perforating the pyriformis, the sciatic nerve emerges from the pelvis, and descending towards the ham, binds down the four next muscles.

On dissecting away the sciatic nerve, a strong tendon is seen interposed between two narrow muscles, which, together with the tendon, are *inserted* into the upper part of the digital fossa within the attachment of the pyriformis.

2. The GEMELLUS SUPERIOR is the uppermost of the two narrow muscles spoken of: it *rises* from the outside of the spinous process of the ischium.

3. The tendon below and cohering with the preceding muscle, belongs to the OBTURATOR INTERNUS: which may be traced abruptly turning round the notch of the ischium, a bursa mucosa being interposed, to a broad fleshy *origin* from the posterior margin of the thyroïd foramen, from the posterior surface of the membrana obturans, and from the adjoining sloping surface of the ilium and ischium.

4. The GEMELLUS INFERIOR is the narrow muscle adhering to the lower margin of the tendon of the obtu-

rator internus: it *rises* from the inner and upper margin of the tuberosity of the ischium.

5. The QUADRATUS FEMORIS is the quadrilateral muscle placed immediately below the preceding, which *rises* from the outer margin of the tuberosity of the ischium, and is inserted into the upper half of the inter-trochantral line, and into about as much of the linea aspera.

6. The OBTURATOR EXTERNUS is found on separating the edges of the gemellus inferior and quadratus: its *origin* from the anterior margin of the thyroïd foramen and the anterior surface of the membrana obturans, is at this stage of the dissection obscurely seen. The strong tendon of this muscle passes transversely behind the neck of the femur, in which it impresses a groove, to be *inserted* into the pit in the digital fossa.

Make an incision through the integuments and fascia lata from the tuberosity of the ischium to the bend of the knee, and dissect the flaps either way; two long muscles are by this means exposed, which descend from the tuberosity of the ischium to the tibia and fibula. These are two of five, which are flexors of the knee-joint, and are called hamstring muscles. Of these, the three first to be described are in addition extensors of the hip-joint; the two last, flexors of the hip-joint; the fourth again, an adductor of the thigh; the fifth, an abductor and a rotator outwards of the thigh.

1. The BICEPS FLEXOR CRURIS, which is the only muscle of the five helonging to the outer edge of the thigh, *rises* by a long head from the upper and *outer* part of the tuberosity of the ischium, by a short head from the lower half of the linea aspera and the upper

half of the outer condyloïd line: it is *inserted* into the head of the fibula.

2. The SEMITENDINOSUS *rises* in common with the long head of the biceps, but from the upper and *inner* part of the tuber ischii, its long tendon is *inserted* into the inner surface of the tibia, a little below the tubercle, and into the aponeurosis of the back part of the leg.

3. The SEMIMEMBRANOSUS *rises* by a broad semicircular tendon, below and without the origin of the long head of the biceps. It is broader than the semitendinosus which covers it, and is *inserted* into the inner and back part of the head of the tibia by a short flat tendon.

For the dissection of the fourth muscle, the limb should be laid upon its outer surface.

4. The GRACILIS *arises* by a thin tendinous and fleshy attachment two inches in depth from the edge of the symphysis and of the arch of the pubes; its breadth of longitudinal fasciculi is disposed along the inner margin of the thigh, and tapers to a round tendon, which is *inserted* immediately above that of the semitendinosus.

The limb is now to be laid upon its back part, with the hip and knee extended, for the dissection of the last muscle of this series.

5. The SARTORIUS *rises* from the superior anterior spinous process of the ilium, crosses obliquely to the inner edge of the thigh, and is finally inserted tendinous immediately above the gracilis: its breadth is about two inches, its length exceeds that of any other muscle. Between the surface of the tibia and the ten-

dons of the semitendinosus, gracilis, and sartorius, bursæ mucosæ are found.

Another muscle *rises* from the anterior superior spinous process of the ilium, called the TENSOR VAGINÆ FEMORIS: it passes down the outer margin of the thigh, being fleshy for from four to six inches, and then terminates in the fascia lata which incloses it. Its *use* is, abduction of the thigh, and to give tension to the fascia lata and support to the femoral muscles.

The fore part of the thigh appears divided obliquely by the sartorius into two regions; the inner bounded internally by the gracilis, the outer externally by the tensor vaginæ femoris. The mass of muscle which occupies the inner region may be called the SEXTUPLEX ADDUCTOR FEMORIS: it contains six muscles, the common uses of which are flexion of the hip, and adduction and rotation outwards of the thigh. The mass of muscle, which occupies the outer region, is the QUADRICEPS EXTENSOR CRURIS.

Of the SEXTUPLEX ADDUCTOR FEMORIS.

1 and 2. The ILIACUS INTERNUS and PSOAS MAGNUS belong to this class; their origins and insertion have been before described, but the latter can only well be seen in the present dissection. A bursa mucosa is interposed between their tendon and the capsular ligament of the hip-joint.

3. The PECTINEUS is in contact with the inner margin of the psoas magnus: it *rises* from the fore part of the body of the os pubis as far back as the linea iliopectinea, and is *inserted* into the lesser trochantral line, having a bursa interposed between it and the neck of the femur.

4. The ADDUCTOR LONGUS is the triangular muscle

which remains between the pectineus and gracilis: its round tendon *rises* from the upper corner of the os pubis adjoining the symphysis. The adductor longus is *inserted* fleshy and tendinous into the lower half of the linea aspera.

5. The ADDUCTOR BREVIS is seen on separating the adductor longus and the pectineus, to *rise* from the fore part of the os pubis between these and the obturator externus: it is *inserted* into the upper part of the linea aspera.

6. On removing the preceding muscles, the anterior surface of the ADDUCTOR MAGNUS is fully exposed. This large muscle, which forms a broad septum between the ham and the anterior region of the thigh, *rises* from the tuberosity and branch of the ischium, and is *inserted* fleshy above and tendinous below into the whole length of the inner margin of the linea aspera, and of the inner condyloïd line. The fibres, which rise anteriorly, run nearly transversely outwards, immediately below and parallel to those of the quadratus femoris: the lower fibres of this muscle have an exclusively tendinous insertion: at the termination of the linea aspera an oblique perforation through the tendon, an inch and an half in length, leads downwards, backwards, and outwards, to transmit the crural artery and vein.

This canal is strengthened above by tendinous fibres derived from the adductor longus and the vastus internus.

It would seem that the lower fibres of the adductor magnus, those, namely, which rise from the back part of the tuberosity, are *used* to extend the hip-joint.

The QUADRICEPS EXTENSOR CRURIS consists of four

parts, which have separate origins, but a common insertion.

1. The central and anterior muscle of the four is the RECTUS FEMORIS, which *rises* by one tendon from the anterior inferior spinous process of the ilium, and by a second external to the first, from the upper margin of the acetabulum. The rectus is *inserted* into the base of the patella.

2. The VASTUS INTERNUS *rises* from the lesser trochantral line, the inner margin of the linea aspera and the inner condyloïd line; its fibres descend obliquely forwards to join the tendon of the rectus, or to be directly *inserted* into the inner margin of the base of the patella.

3. The VASTUS EXTERNUS *rises* from the lower margin of the great trochanter, from the outer margin of the linea aspera, and outer condyloïd line, and from the adjoining external surface of the bone; its fibres descend obliquely forwards and inwards, join the tendon of the rectus, and are partly *inserted* separately and externally to it into the base of the patella.

4. The CRUREUS *rises* from the fore and outer part of the femur, a narrow line intervening between it and the origins of the two vasti above. Lower down, a space of an inch in breadth separates its margin from the *origin* of the vastus internus, while its outer margin is blended with *that* of the vastus externus. A little above the patella the four muscles coalesce. The crureus is *inserted* into the base of the patella equally with the other three; they act upon the tibia through the ligamentum patellæ. They are all extensors of the knee-joint, and the rectus in addition is a flexor of the hip joint.

A bursa mucosa is interposed between the skin and the patella.

The fascia lata of the thigh is not adherent to the muscles it covers; it is reflected at the back part across the interval between the flexors of the knee, and a production of a similar nature descends upon the calf of the leg to the heel. Turn the limb upon its fore part again, and prepare to dissect the muscles at the back part of the leg by cutting through the integuments, covering the inner surface of the tibia: dissect off the skin and fascia separately. The three muscles to be first exposed are situated one before the other.

1. The GASTROCNEMIUS *rises* by two heads, each tendinous above and fleshy below, one from the upper outer and back part of each condyle; these expand into broad oval bellies terminating on the flat commencement of the tendo Achillis, which becoming gradually rounded, is *inserted* into the middle of the posterior surface of the os calcis, a bursa being interposed between the tendon and the upper part of this surface.

2. On detaching the heads of the gastrocnemius, a slender muscle, the PLANTARIS, may be seen to *rise* from the outer condyle below the preceding; its fleshy part is about three inches in length; its slender tendon passes obliquely before the gastrocnemius to gain the inner margin of the tendo Achillis, before which it passes to the os calcis, into the upper and back part of which it is *inserted:* the Plantaris is often wanting.

3. The muscle now completely exposed is the SOLEUS, which *rises* from the upper half of the posterior margin of the fibula, from the oblique ridge of the tibia, and below this from its inner margin half way

down: the fleshy portion of the soleus extends lower than that of the gastrocnemius, before it terminates in the tendo Achillis.

The gastrocnemius and soleus are *used* to extend the ancle joint: the former in addition to bend the knee: the plantaris must contribute slightly to both these motions.

On removing the soleus, other muscles are seen through a fascial expansion, which extends from the inner and posterior margin of the tibia to the outer edge of the fibula, and gives attachment to the upper part of the muscles it covers: on dissecting off the skin from the fore part of the leg, a similar but stronger fascia is seen to invest the muscles of this region. Thus one final order of muscles immediately investing both surfaces of the bones of the leg remains to be dissected. These are the following:

The POPLITEUS is a triangular muscle, situated behind the knee, it *rises* from the capsular ligament covering the lower and outer part of the external condyle, and is *inserted* into the tibia above its oblique line: its *use* is flexion of the knee.

2. The FLEXOR LONGUS DIGITORUM PEDIS *rises* from more than the middle half of the posterior surface of the tibia: its tendon in a subsequent dissection is found to be *inserted* into the under part of the bases of the third phalanges of the four lesser toes.

3. The TIBIALIS POSTICUS *rises* from the interosseous ligament and the adjoining margins of the tibia and fibula, towards the lower part of the leg; its tendon becoming more internal lies before that of the preceding muscle. The two tendons pass in a common sheath behind the malleolus internus, in a groove of the tibia.

The tendon of the tibialis posticus is *inserted* by distinct slips into the under part of the os calcis, of the os cuboïdes, of the os cuneïforme, into the inner margins of the bases of the third and fourth metatarsal bones, into the under surface of the naviculare and cuneïforme internum.

4. The FLEXOR LONGUS POLLICIS PEDIS *rises* from the lower two-thirds nearly of the posterior and inner surfaces of the fibula; it is a larger muscle than either of the preceding; its tendon passes along a separate groove external to that just noticed, and is finally *inserted* into the under part of the base of the last phalanx of the great toe.

The three last described muscles are extensors of the ancle joint and adductors of the foot; the flexor longus pollicis in addition bends the joints of the great toe, and the flexor longus digitorum those of the lesser toes.

5. Upon the outside of the leg, the PERONEUS LONGUS *rises* from the upper two-thirds of the outer surface of the fibula, from a broad surface above, from a narrow line below.

6. The PERONEUS BREVIS *rises* from the lower two-thirds of the same surface, and anterior to the preceding. These two muscles follow the slanting direction of the outer surface of the fibula, their tendons pass in the same sheath behind the outer ancle; but that of the peroneus brevis is inserted into the under part of the os cuboïdes and into the base of the metatarsal bone of the little toe, while that of the peroneus longus turning over the edge of the os cuboïdes runs obliquely forward in a groove of its under surface, to be finally *inserted* into the os cuneïforme internum and into the

bases of the metatarsal bones of the great and second toe. These two muscles are extensors of the ancle joint and abductors of the foot.

The dissection has now reached the fore part of the leg, in dissecting off the fascia of which you notice its strict cohesion with the subjacent muscles for the upper third of the limb. The muscles of this region are all flexors of the ancle; their further actions will be mentioned with each individually.

7. The PERONEUS TERTIUS *rises* by a narrow origin from the lower part of the anterior margin of the tibia; it is not unfrequently wanting, and commonly is but an additional tendon of the next muscle. This tendon passes underneath the annular ligament of the ancle-joint, and is *inserted* into the upper and outer part of the base of the metatarsal bone of the little toe. Its additional *use* is abduction of the foot.

8. The EXTENSOR DIGITORUM COMMUNIS *rises* above from the head of the tibia, and interosseous ligament, and from the anterior surface of the fibula for the whole length of the leg: its tendon subdivides into four slips, one inserted into the backs of all the phalanges of each of the four lesser toes, all the joints of which it extends.

9. The EXTENSOR PROPRIUS POLLICIS PEDIS *rises* from the lower two-thirds of the surface of the fibula to which the interosseous ligament is attached and from that ligament; its tendon is *inserted* into the phalanges of the great toe: its additional *use* is adduction of the foot.

10. The TIBIALIS ANTICUS *rises* from the two upper thirds nearly of the outer surface of the tibia and adjoining interosseous ligament; its origin is broad

above, but tapers to a line below: its tendon turns over the inner margin of the instep and is *inserted* into the inner edge of the os cuneïforme internum, and base of the metatarsal bone of the great toe: its additional *use* is adduction of the foot.

The annular ligaments, which confine tendons passing over joints are but partial thickenings of the fascia of the limb: that which extends from the inner malleolus to the os calcis is of great strength, and called the *ligamentum laciniatum.*

Upon the instep the EXTENSOR BREVIS DIGITORUM PEDIS remains to be dissected: it *rises* fleshy from the upper and fore part of the os calcis, and its four tendons are inserted into the phalanges of the four greater toes: its name expresses its *use.*

The INTEROSSEI EXTERNI or BICIPITES are four in number, and *rise* as in the hand from the opposite surfaces of two adjoining metacarpal bones; the innermost is *inserted* into the inside of the base of the first phalanx of the second toe: the second similarly on the outside of the same bone: the third similarly on the outside of the third toe: the fourth similarly on the outside of the fourth toe.

The sole of the foot is protected by a strong ligamentous expansion called the *fascia plantaris;* of which the central and largest part extends from the convex margin of the tuberosity of the os calcis to the five joints of the metatarsal bones and phalanges of the toes: the outer part extends from the outer part of the same margin of the os calcis, to the base of the metatarsal bone of the little toe: the inner division, which is slighter still, extends from the inner part of the same margin as a continuation of the ligamentum laciniatum,

to form an aponeurotic covering to the abductor pollicis pedis: from the great central portion of the plantar fascia, several finer productions are derived which invest and support the muscles at the fore part and edges of the sole of the foot.

Upon removing the plantar fascia, muscles are seen corresponding with those in the hand.

The ABDUCTOR POLLICIS PEDIS *arises* from the ligamentum laciniatum and from the inner and posterior edge of the os calcis: its tendon is *inserted* into the inside of the base of the first phalanx of the great toe: its name denotes its *use*.

The FLEXOR BREVIS POLLICIS PEDIS *arises* from the under surface of the os calcis and os cuneïforme externum, and is *inserted* into either sesamoïd bone; the tendon of the long flexor is situated between the two portions of the flexor brevis.

The ADDUCTOR POLLICIS PEDIS *arises* from the under surface of the os calcis and of the os cuboïdes, and is *inserted* into the outside of the base of the first phalanx of the great toe. The terms adduction and abduction have reference in this case to the centre of the foot.

On the outside the ABDUCTOR MINIMI DIGITI PEDIS *rises* from the outer and inferior margin of the os calcis, and is inserted into the outside of the base of the metatarsal bone of the little toe, and to the outside of the base of its first phalanx.

The FLEXOR BREVIS MINIMI DIGITI PEDIS *rises* within the former from the under surface of the os cuboïdes, and is *inserted* into the fore part of the base of the first phalanx of the little toe: its name denotes its *use*.

Centrally the FLEXOR BREVIS DIGITORUM PEDIS *rises* from the margin of the tuberosity of the os calcis; its four tendons are perforated by those of the long flexor, and are then *inserted* into the under part of the bases of the second phalanges of the lesser toes: its name denotes its *use*.

On raising this muscle from its origin the FLEXOR ACCESSORIUS is seen to *rise* from the same bone above and before the flexor brevis; its *insertion* is into the tendon of the flexor longus, (with which muscle it co-operates) just before its division in the centre of the foot.

The *four* LUMBRICALES arise from the inner margins of the four tendons of the long flexor, and are inserted into the inner sides of the first and second phalanges of the four lesser toes.

The TRANSVERSUS is seen on the removal of the flexor tendons: it runs across as a slight muscle about half an inch broad, from the outside of the metatarsal joint of the great toe with the first phalanx to the corresponding joint of the little toe. Its *use* is to narrow the fore part of the foot rendering its under surface concave.

The INTEROSSEI INTERNI are three in number; each *rises* from the side of the metatarsal bone of the toe, into the base of the first phalanx of which it is *inserted*. The outermost is an adductor of the little toe, the second of the next toe, and the innermost of the middle toe.

CHAPTER II.

§ I. OF THE NATURE OF JOINTS.

WHERE parts are not directly blended with each other, as tendons with the periosteum, media are interposed, which confine or facilitate their reciprocal movements within certain limits.

The *cellular membrane* is the common medium of connection between parts in the human body: the cells which this thin membrane encloses communicate so freely, that air or water introduced at any one point will permeate the whole system. The cellular membrane intervenes between dissimilar textures, between separate organs, and even between their component parts, as their means of joining: thus in the sutural union of bones it forms the only substance interposed.

But other substances are employed, though less extensively, for the same purpose; of which nature are portions of fibrous cartilage interposed between bones, forming *synchondroses*, which admit indeed of little movement between the united surfaces, though they give considerable elastic strength to parts thus joined. *Ligaments* are commonly added in such cases to connect neighbouring surfaces of bones, which are articulated together by intervening fibrous cartilage. Sometimes sacs of thin membrane are employed, which are reflected over the opposite surfaces of parts: the inner surface of such membranes is lubricated by a continual secretion, so that the parts thus disunited move so much the more readily on each other.

Of this nature are *serous membranes*, which have been already spoken of; and *synovial membranes*, which are employed exclusively in the formation of joints, and are as fine, but of much less dimensions than the former. When interposed between tendon or skin on the one hand, and tendon, cartilage, or bone on the other, these synovial sacs are called *bursæ mucosæ:* when reflected over the cartilaginous ends of bones articulated together, they complete the most perfect form of osseous joints; that, namely, which gives perfect facility and definite limits to motion.

Joints of this sort are systematically subdivided according to the forms of the extremities of bones, which meet in them. One sort is called an *enarthrosis*, or *ball and socket joint*, as for instance that of the hip, which admits of secure and extensive movement in every direction; another sort is called an *arthrodia*, where the surfaces reciprocally opposed are plane, or nearly so; this kind admits of little motion, but of that little equally in each direction. The third sort is the *ginglymus* or *hinge joint*, in which the movement is in one plane only; either *angularly*, as in the bending of the elbow, or *rotatory*, as in the movement of the atlas round the odontoïd process of the dentata.

I have already spoken of the principal bursæ mucosæ, and proceed to describe the joints of the skeleton, which may be dissected after the removal of the muscles.

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§ II. OF THE LIGAMENTS OF THE VERTEBRÆ.

Saw through at about four lines from and parallel to the median plane a portion taken from the middle of

the vertebral column. Upon carefully dissecting off the muscles, vessels, nerves, or serous membranes, which may adhere to its surface, the following ligaments may be made out.

1. The FASCIA LONGITUDINALIS ANTICA is a flat strip of ligament, which extends from the fore part of the atlas to the upper lumbar vertebræ, below which its place is supplied by the tendons of the crura of the diaphragm: it is thicker at the upper part of the neck and of the back than elsewhere.

2. The FASCIA LONGITUDINALIS POSTICA is a similar expansion, which extends along the posterior surfaces of the bodies of the vertebræ, from the second or third of the neck to the uppermost in the loins. This ligament is broader at its upper part than below, and at the intervals of the vertebræ than upon their bodies.

3. The INTERVERTEBRAL SUBSTANCE is the material interposed between the bodies of the vertebræ, centrally pulpy, disposed externally in concentric rings of ligament more and more dense and elastic as nearer the surface: the external layer consists of

4. The LIGAMENTA CRUCIATA, which are oblique and reciprocally decussating fibres that pass between the opposite margins of adjoining vertebræ.

5. The LIGAMENTA SUBFLAVA are thick semicircular slips of yellow elastic ligament, which connect the opposite margins of the bony arches of adjoining vertebræ.

6. The MEMBRANA INTERSPINALIS is a ligamentous membrane which connects the opposite margins of adjoining spinous processes.

7. The FUNICULI LIGAMENTOSI are ligamentous chords which connect the apices of adjoining spinous processes.

8. The LIGAMENTA PROCESSUUM TRANSVERSORUM are chords which unite the adjoining transverse processes of the fifth, sixth, seventh, eighth, ninth, tenth, and eleventh dorsal vertebræ.

The articular processes of the vertebræ are tipped with cartilage, invested with synovial membranes and capsular ligaments, and form arthrodial joints.

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§ III. OF THE LIGAMENTS BETWEEN THE ATLAS, DENTATA, AND OS OCCIPITIS.

1. The LIGAMENTA ANNULI ANTERIORIS and ANNULI POSTERIORIS are the two parts of a strong membrane, which descends from the margin of the foramen magnum to the upper edge of the atlas, before and behind its joints with the condyles of the os occipitis. Cut away the bony arches of the four upper cervical vertebræ, and a corresponding portion of the occiput, and dissect off the theca vertebralis.

2. The APPARATUS LIGAMENTOSUS WINSLOVII is a broad ligament, which passes from the basilar process of the occipital bone behind the odontoïd process to be inserted into the bodies of the second, third, and fourth cervical vertebræ; from the lower part of this ligament the fascia longitudinalis postica is produced.

Make a longitudinal incision so as to remove one half of the apparatus ligamentosus.

3. The LIGAMENTUM TRANSVERSALE is a thick flattened chord immediately in contact with and before the preceding, extended across the atlas from side to

side so as to confine the odontoïd process. Its *superior appendage* passes to the margin of the foramen magnum. Its *inferior appendage* to the root of the odontoïd process.

4. The LIGAMENTA LATERALIA ascend obliquely one from either side of the summit of the odontoïd process to the scabrous surface within either condyle of the os occipitis.

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§ IV. OF THE LIGAMENTS OF THE RIBS AND SPINE.

1. and 2. The LIGAMENTA CAPITELLI COSTÆ, SUPERIUS and INFERIUS, are radiated ligamentous fibres, which pass from the head of a rib to the bodies of the two adjoining vertebræ: frequently a distinct synovial membrane is found within each.

3. and 4. The LIGAMENTA CERVICIS COSTÆ ANTICUM AND POSTICUM are bands of fibres ascending obliquely from the neck of a rib to the lateral processes of the vertebra above. The former outwards to the transverse process, the latter inwards to the inferior oblique as well as to the transverse process.

5. An arthrodial joint exists between the transverse processes of the upper ten vertebræ and the articular tubercles of the corresponding ribs.

6. The LIGAMENTUM COSTÆ TRANSVERSALE consists of a flat fasciculus passing from the extremity of a transverse process to the upper and outer surface of the tubercle of the rib, with which it is articulated.

§ V. OF THE LIGAMENTS OF THE PELVIS.

1. The ossa pubis are joined by a layer of intervening fibrous cartilage, strengthened externally by transverse ligamentous fibres: the whole included under the term COMMISSURA OSSIUM PUBIS.

2. The sacro-iliac joint or synchondrosis is of a similar nature, but strengthened by the following numerous ligaments remote from the joint itself.

3. The LIGAMENTUM PELVIS ANTICUM SUPERIUS TRIANGULARE extends from the transverse process of the fourth lumbar vertebra to the crest of the ilium.

4. The LIGAMENTUM PELVIS ANTICUM INFERIUS ROTUNDUM extends from the transverse process of the fifth lumbar vertebra to the crest of the ilium.

From the tuberosity of the ilium three ligaments extend to the sacrum;

5. The LIGAMENTUM POSTICUM LONGUM vertically to the side of the os sacrum;

6. The LIGAMENTUM POSTICUM BREVE obliquely downwards and backwards, behind and within the preceding to the side of the sacrum;

7. The LIGAMENTUM LATERALE transversely towards the spinous processes of the sacrum.

8. The LIGAMENTUM SACRO-SCIATICUM ANTICUM extends transversely from the side of the sacrum and os coccygis to the spinous process of the ischium.

9. The LIGAMENTUM SACRO-SCIATICUM POSTICUM or MAJUS rises from the same margin of bone, descends obliquely tapering towards the tuber ischii, into the inner and upper margin of which it is inserted: the aponeurotic production of this ligament along the

margin of the ischium forwards, is called the *productio falciformis Winslovii.*

10. The LIGAMENTA OSSIS COCCYGIS LONGITUDINALIA are two ligamentous bands extended along the dorsum of the os coccygis from the sacrum.

11. The MEMBRANA OBTURANS closes the thyroïd foramen, having an oblique opening externally and above for the obturatrix artery and its accompanying nerve; a *chorda transversalis* strengthens the membrane below this opening.

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§ VI. OF THE LIGAMENTS OF THE HIP JOINT.

1. The MEMBRANA CAPSULARIS of great thickness extends from the margin of the acetabulum an inch down the neck of the femur; it is thickest anteriorly, where corroborating fibres are derived to it from the anterior inferior spinous process of the ilium.

This membrane when divided is in parts with difficulty reflected back upon the neck of the femur, owing to the *retinacula ligamentosa*, or slips of membrane which pass to it from the margin of the head of the bone.

2. The LIGAMENTUM TERES is a triangular chord an inch long, extending from the lower and fore part of the acetabulum to the fossa at the head of the femur: it limits the rotation of the femur either inwards or outwards.

3. The LABRUM CARTILAGINEUM is a band of fibrous cartilage which deepens the socket of the acetabulum; being strengthened anteriorly, where the bone

is deficient by a *ligamentum labri externum*, and one *internal.*

Fatty matter is found in the fossa of the acetabulum. The synovial membrane covers the neck of the femur for eight or ten lines from the margin of the head of the bone.

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§ VII. OF THE LIGAMENTS OF THE KNEE JOINT.

The MEMBRANA CAPSULARIS descends from the sides of the condyles of the femur, and intermediately from its shaft to the scabrous margin of the head of the tibia: it is thin above and anteriorly where the tendon of the rectus protects it; lower down it contains the patella: it is strengthened by the following accessory fasciculi.

2. The LIGAMENTUM PATELLÆ, which descends from the inner and outer edges, and from the apex of the patella to be inserted into the lower part of the tubercle of the tibia; a bursa mucosa being interposed between this ligament and the smooth upper portion of the tubercle.

3. The LIGAMENTUM LATERALE EXTERNUM LONGUM, which descends from the side of the outer condyle to be inserted into the fore part of the neck of the fibula.

4. The LIGAMENTUM LATERALE EXTERNUM BREVE, which descends behind the former to be inserted into the summit of the fibula.

5. The LIGAMENTUM POSTICUM WINSLOVII, which descends obliquely from the outer condyle to the inner and posterior edge of the head of the tibia.

6. The LIGAMENTUM LATERALE INTERNUM, which descends vertically from the inner condyle to be inserted into the head and inner margin of the tibia.

7, 8, 9. Cut through the capsular ligament anteriorly above the patella and turn it down: fat covered by synovial membrane is seen to occupy the space between the condyles: a reflexion of little more than synovial membrane from this to the fat below the patella is called the LIGAMENTUM MUCOSUM; and its two falciform edges which spread from this point laterally and disappear, are called LIGAMENTA ALARIA, INTERNUM MAJUS, EXTERNUM MINUS.

10, 11. Cut through the capsular ligament vertically before the lateral ligaments, so as completely to turn down the patella. Either hollow of the head of the tibia appears deepened by a semilunar cartilage, the substance of which tapers to an edge internally: the horns of each are attached to the central roughness of the bone; their convex margins laterally and behind adhere to the capsular ligament.

12. The LIGAMENTUM TRANSVERSALE or CORONARIUM is a thin fasciculus, which runs in front of the head of the tibia to connect the prominent anterior margins of the semilunar cartilages.

13. The LIGAMENTUM CRUCIALE POSTICUM runs vertically down from the outer surface of the inner condyle to the back part of the central roughness of the head of the tibia.

14. The LIGAMENTUM CRUCIALE ANTICUM descends obliquely from the inner surface of the outer condyle to the fore part of the roughness just alluded to, so as to cross before the last-described, and thus to lock the knee, which cannot when all the former ligaments

are cut through be rotated inward: but the rotation of the leg outward is then practicable, which is seen to untwist the two crucial ligaments. In general at their insertion these ligaments are connected with the semilunar cartilage of the opposite side.

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§ VIII. OF THE LIGAMENTS OF THE LEG, AND ANCLE JOINT, AND FOOT.

1, 2. The fibula is articulated above with the tibia by means of an arthrodial joint, and is connected all the way down with the same bone by means of the MEMBRANA INTEROSSEA, an expansion of ligamentous fibres, which descend obliquely from the tibia; above the membrana interossea is defective to transmit the anterior tibial artery.

3, 4. At the inferior juncture of these bones two fasciculi descend, one from the fore the other from the back part of the tibia to the malleolar process of the fibula: each of them is subdivided into an upper and an under portion: they are termed LIGAMENTA INTER TIBIAM ET FIBULAM ANTICA, OR POSTICA.

5. The ancle joint is formed by the tibia, fibula, and astragalus. The CAPSULAR LIGAMENT is slight, and the joint derives its strength from lateral ligaments.

6. The LIGAMENTUM TRIANGULARE OR DELTOÏDES is placed on the inside: it descends from the margin of the inner malleolus to the astragalus, to the internal process of the os calcis, and to the trochlea cartilaginea.

On the outside are three ligaments derived from the extremity of the fibula.

7. The LIGAMENTUM PERPENDICULARE MEDIUM to the side of the os calcis.

8. The LIGAMENTUM INTER FIBULAM ET ASTRAGALUM ANTICUM descending obliquely forwards and inwards.

9. The LIGAMENTUM INTER FIBULAM ET ASTRAGALUM POSTICUM descending obliquely backwards and inwards.

10. The TROCHLEA CARTILAGINEA is a thick portion of fibrous cartilage, which is extended from the inner prominence of the os calcis to the inferior extremity of the naviculare: it materially strengthens the ancle joint: the lower, inner, and anterior surface of the astragalus rests upon it.

The separate joints of the instep are between the astragalus and os calcis, between the former again and the naviculare, between the latter and the cuboïdes; between the naviculare and the three cuneïform bones, and between the external of these and the os cuboïdes. With the last named the metatarsal bones are articulated arthrodially; the joints beyond are pure hinge joints, in the composition of which you notice a *capsular ligament*, with a *lateral ligament* on either side. It is scarcely necessary to distinguish separately the *oblique ligamentous fasciculi*, which strengthen the capsular membranes upon the instep; nor the range of *transverse ligaments* below, which connect together the cuneïform bones and the bases of the metatarsal bones: but you will not fail to observe four ligaments, which extend forwards from the os calcis to the fore and under part of the tarsus.

Two ligaments connect the os calcis with the naviculare derived from the anterior and under part of the

former. The outer, or LIGAMENTUM PLANUM, being continuous laterally with the trochela cartilaginea: the inner parallel to this is called the LIGAMENTUM TERES.

Two ligaments connect the os calcis with the os cuboïdes: the outer, or LIGAMENTUM LONGUM, rises immediately before the flexor accessorius and extends directly forward.

The second, or LIGAMENTUM OBLIQUUM, rises still further forward, and is inclined inward as well as forward.

The os naviculare again is specially connected laterally and below by ligamentous fibres with the internal cuneïform bone: the lateral part being called the LIGAMENTUM PLANTARE MAJUS; that below, the LIGAMENTUM PLANTARE MINUS.

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§ IX. OF THE LIGAMENTS OF THE RIBS AND STERNUM.

The cartilages of the seven upper ribs are received into oval cavities at the side of the sternum. The membrane covering the sternum is in part ligamentous and continuous with the perichondrium of the cartilages of the ribs. A ligamentous fasciculus passes on either side from the fore part of the ensiform cartilage to the cartilage of the seventh or of the sixth rib: till late in life a layer of cartilage is interposed between the triangular and oblong bones of the sternum, which is thicker behind than before. The cartilages of the three upper false ribs are joined each to that above by thin fasciculi of oblique ligamentous fibres.

§ X. OF THE LIGAMENTS OF THE STERNUM AND CLAVICLE AND FIRST RIB.

1. The LIGAMENTUM INTERCLAVICULARE extends its fibres from the sternal end of one clavicle across to that of the opposite: these fibres adhere to the upper margin of the sternum.

2. The LIGAMENTUM INTERCLAVICULAM ET COSTÆ PRIMÆ CARTILAGINEM *rises* from the sternal end of the cartilage of the first rib, and ascends obliquely outwards to the under margin of the clavicle.

3. The CAPSULAR LIGAMENT gives attachment to an intermediate fibrous cartilage, which is interposed between the articular surfaces of the clavicle and sternum, and adheres to the articular surface of the latter.

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§ XI. OF THE LIGAMENTS OF THE SHOULDER.

A. Between the clavicle and scapula.

1. The joint is arthrodial, that is to say, consists of two plain surfaces apposed to each other, invested with cartilage, synovial membrane, and capsular ligament: in this joint an interarticular cartilage is found, as at the opposite extremity of the clavicle.

The ligaments which strengthen this articulation are remote from it.

2. The LIGAMENTUM CONOÏDES extends from the root of the coracoïd process of the scapula to the inner

extremity of the oblique ridge upon the under surface of the scapular end of the clavicle.

3. The LIGAMENTUM TRAPEZOÏDES ascends from the upper surface of the coracoïd process to the outer part of the same oblique ridge.

B. Of the scapula exclusively.

1. The LIGAMENTUM PROPRIUM POSTICUM runs from margin to margin of the notch of the scapula, so as to convert it into a foramen.

2. The LIGAMENTUM PROPRIUM ANTICUM or TRIANGULARE rises by a broad base from the posterior surface of the coracoïd process, and is inserted narrower into the extremity of the acromion: it forms the support of the shoulder joint above.

C. Between the scapula and the humerus.

1. The MEMBRANA CAPSULARIS is remarkably capacious, extending from the neck of the scapula to that of the humerus: it is thickest and most confined internally and below. It is strengthened by a *membrana adscititia*, which descends from the inferior surface of the coracoïd process.

2. A LABRUM CARTILAGINEUM of fibrous cartilage deepens the joint, adhering at its convex margin to the membrana capsularis, and by one surface to the margin of the glenoïd cavity, and being connected (generally by its posterior segment) with the tendon of the long head of the biceps flexor cubiti.

§ XII. OF THE LIGAMENTS OF THE ELBOW.

1. The MEMBRANA CAPSULARIS is reflected from either condyle, and intermediately from the shaft of the humerus above the fossæ, into which its lower part is excavated, to the margin of the olecranon and coronoïd process of the ulna, and to the neck of the radius.

2. The LIGAMENTUM LATERALE INTERNUM descends from the inner condyle of the humerus to the inside of the coronoïd process.

3. The LIGAMENTUM LATERALE EXTERNUM descends from the outer condyle to the neck of the radius.

These ligaments suffice for the hinge joint of the elbow: to allow of the movement of the radius upon the ulna, you notice that neither the external lateral nor capsular ligaments take any close adhesion to the neck of the radius; but that the latter, having surrounded the head of the radius, is simply constricted at its neck, yet sufficiently to retain it in apposition with the humerus.

4. The LIGAMENTUM ORBICULARE is the name given to the thickened part of the capsular ligament which surrounds the head of the radius.

5, 6. The LIGAMENTA ANNULI ANTERIORIS, and ANNULI POSTERIORIS, are fasciculi distinct from the substance of the capsular membrane, which pass transversely from the fore and back part of the ligamentum orbiculare to the margins of the olecranon and coronoïd process.

A particular fasciculus extends from the inner margin of the olecranon to the inner margin of the coronoïd process.

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§ XIII. OF THE RADIUS AND ULNA, OF THE WRIST AND HAND.

1. The radius and ulna are further united by a MEMBRANA INTEROSSEA, the fibres of which descend obliquely from the radius to the ulna, and are defective above.

2. The CHORDA TRANSVERSALIS CUBITI is a fasciculus, which descends obliquely from the base of the coronoïd process of the ulna to the radius below its tubercle.

3. The MEMBRANA CAPSULARIS SACCIFORMIS unites the radius and ulna below; it is reflected from the head of the ulna and opposite margin of the radius downwards to the edges of a triangular cartilage, the base of which coheres with the concave margin of the radius, its apex with the styloïd process of the ulna.

One *capsular membrane* extends from the radius and ulna to the naviculare, lunare, and cuneïforme: internally this must be regarded as a production of the membrana capsularis sacciformis.

A second *capsular membrane* connects the first and second rows of carpal bones.

The preceding capsular membranes and those which connect the carpal and metacarpal bones are strengthened by additional fasciculi, which on the back part

diverge from the os cuneïforme to the radius, ulna, and metacarpal bones, laterally run from bone to bone, and anteriorly spread principally from the body of the os unciforme.

The LIGAMENTUM CARPI PROPRIUM or TRANSVERSALE passes across as a flat band of great strength and thickness from the os pisiforme and the hook-like extremity of the os unciforme to the trapezium and naviculare.

The joints of the metacarpal bones with the phalanges, and of the latter among themselves, are *hinge joints*, in which you observe *capsular membranes* and *lateral ligaments:* the flexor tendons are confined by thick *annular ligaments* as well as by special *crucial ligaments* anterior to the joints of the phalanges.

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§ XIV. OF THE LIGAMENTS OF THE LOWER JAW AND TEMPORAL BONE.

The CAPSULAR LIGAMENT, which is slight, descends from the extensive margin of the digital fossa of the temporal bone to the neck of the condyle of the lower jaw: it gives attachment to an oval interarticular cartilage, which is so thin transversely at its middle as rather to form two separate portions united by a membrane. On the outside is an EXTERNAL LATERAL LIGAMENT.

CHAPTER III.

OF THE BRAIN, AND NERVES, AND OF THE ORGANS OF VISION, HEARING, TASTE AND SMELL.

§ I. DISSECTION OF THE BRAIN.

Saw the skull through circularly at the distance of half an inch above the orbit at the fore part, and somewhat higher than the tubercle of the os occipitis behind. On tearing off the skull-cap, the *dura mater*, with which it closely cohered, is seen; covered with numerous bloody points resulting from the rupture of vessels, which passed from it into the bone. The dura mater is a thick membrane of a close ligamentous texture, and of great strength; it forms the periosteal lining of the skull, the principal arteries of which it conveys: the largest of these, the arteria meningea media, is seen to ascend from the anterior inferior angle of the parietal bone, and to distribute its branches upon the side of the dura mater.

Upon the upper part of the dura mater little corpuscles of the colour of fat, termed *glandulæ Pacchioni externæ*, are occasionally met with singly or in clusters, which are received into corresponding fossæ of the inner table of the skull. In the median plane a longitudinal depression is seen: on making an incision at this part, you open a triangular vein incased in the dura mater, called the *superior longitudinal sinus*. The cavity of the sinus enlarges in its course towards the occiput, is strengthened by numerous oblique bands internally, to

which adhere more or fewer clustering corpuscles called *glandulæ Pacchioni internæ*, and receives as many as twelve veins from the brain on either side, which enter obliquely from behind forwards. The great veins of the brain being inclosed in the firm substance of the dura mater are thus prevented dilating, as in other parts, when the return of the blood to the heart is accidentally retarded.

Cut the dura mater through upon one side, and invert the flap: you thus expose an uniform serous surface. The *tunica arachnoïdes* is the serous membrane of the brain: in the present instance, you may with some care dissect it off from the fibrous dura mater, of which it invests the inner surface, and from which it is reflected at various points over the surface of the brain. At the furrows of the brain, the tunica arachnoïdes is more readily separable, as it does not follow the various involutions of the surface, but passes directly across from one margin to the opposite. The tunica arachnoïdes is quite transparent, and naturally shews no vascularity: the vessels, which are seen upon the surface of the brain, are contained in the third membrane or *pia mater*, or proper tunic of the brain, which invests its surface, and is blended with its entire composition. The outer, *cortical*, or *cineritious* matter of the brain, is seen then in the present instance through the tunica arachnoïdes and the pia mater, modelled by curvilinear furrows into the appearance termed *convolutions* of the brain. Either half of the brain is termed an *hemisphere*.

Cut through the veins which are seen to enter the *superior longitudinal sinus*, and press the exposed hemisphere to one side: a process of the dura mater,

called the *falx cerebri*, is seen to descend in the median fissure, having below a curvilinear edge, which likewise contains a vein called the *inferior longitudinal sinus*. The falx cerebri is attached anteriorly to the crista Galli. Cut through the dura mater covering the opposite hemisphere, divide the anterior part of the falx cerebri; and finally, turn the dura mater back, so as to expose both hemispheres.

On pressing the hemispheres apart, a white body which unites them is seen at the bottom of the median fissure, called the *commissura magna cerebri*, or *corpus callosum;* it is three inches and an half in length, slightly convex above, having a narrow convex anterior margin, a broader concave posterior margin; it is nearer to the frontal than to the occipital extremity of the brain. A slight groove upon it in the median plane bounded by two raised lines is called the *raphe:* externally to this, the corpus callosum is transversely fluted.

Cut away horizontally a slice from one hemisphere, at half an inch above the corpus callosum: the appearance of central white matter, shewing at its margin the depth of the convolutions and the thickness of the cortical or cineritious substance, is called the *centrum ovale minus*.

Cut away both hemispheres horizontally, and from within outwards at the level of the corpus callosum; the appearance thus produced is termed the *centrum ovale majus*.

Cut vertically through the outer margin of the commissura magna; a cavity is thus opened, called the *lateral ventricle*. Air blown into this cavity is seen to distend a similar cavity on the opposite side. Continue the incision parallel to the raphe, and turn aside the

divided medullary matter, you observe that the *roof* of the lateral ventricle is formed by the corpus callosum and adjoining medulla of the hemisphere; that the *outer surface* or *wall* is formed of cineritious matter, is pyriform, is broader before than behind, is convex, and slants obliquely upwards and outwards. The substance which has these characters is called the *corpus striatum*, from the alternate white and grey matter, of which it appears composed, when a transverse section is carried through it. The lower margin of the corpus callosum is bordered by a narrow grey line, called the *tænia semicircularis geminum*, where it meets the floor of the ventricle, which at its narrowest part is nearly half an inch in width.

The *floor* of the lateral ventricle is composed externally of the white prominence of the *thalamus nervi optici*, partly denuded, internally covered by the *plexus chorioïdes*, a tissue of convoluted vessels contained in a reduplicature of the pia mater, which advances forward and inward, and seems itself lost below the third portion of the floor; this consists of a band of white matter, called the *fornix*, the inner edge of which joins its fellow at the median plane, the outer margin being unattached and concave.

The *inner wall*, or partition of the ventricles, is called the *septum lucidum:* on opening the opposite ventricle, the partial transparency of the septum is observable. The septum lucidum extends from the under surface of the commissura magna to the upper surface of the fornix in the median plane: its height is three or four lines. Cut through the corpus callosum, and reflect its two portions, tearing gently through its adhesion to the septum lucidum. The latter now appears

formed of two plates enclosing a narrow cavity broader before than behind, the *ventricle* of the septum lucidum: this cavity is naturally closed; each of its walls is composed of two layers, the outer grey, the inner white.

Each hemisphere is described as consisting of *three lobes:* the *posterior* is measured off by an imaginary line extending transversely from the posterior margin of the corpus callosum; the *anterior* is separated from the *middle* by a deep fissure which receives the lesser wing of the sphenoïd bone, and is termed the *fissura Sylvii.*

The lateral ventricle is prolonged into the three lobes by three cornua. The *anterior cornu* slopes outward to a point round the convex anterior margin of the corpus striatum; the *posterior cornu* is incurvated first outwards, then backwards, and finally narrows to a point, which looks inwards: its surfaces are of white matter, its floor is convex, and termed the *hippocampus minor.* The *middle*, or *inferior* cornu slopes outwards, then forwards, and finally inwards, being throughout inclined downwards, so as to open below upon the under surface of the brain. In following the inferior cornu, you may find it convenient to remove some of the lateral part of the brain. The floor of the inferior horn is white, convex, and is termed the *hippocampus major:* it terminates in a broader and indented surface called the *pes hippocampi;* the thin layer of medullary matter which overlaps its inner margin, is called the *tænia hippocampi.* Between this and the convolutions of the brain, a curiously serrated layer of grey matter, two lines in depth, called the *indented border*, is interposed, which extends from the under surface of the

posterior fold of the corpus callosum to the pes hippocampi.

You may observe that the hippocampus major, the hippocampus minor, and tænia hippocampi, are continuous with a production of the fornix; this is termed the *posterior crus* of the fornix. The reflection of the pia mater, which forms the plexus chorioïdes, enters the ventricle at its inferior horn; ascends, forming its carpeting; then is distributed along the floor of the lateral ventricle disappearing finally below the fornix, under which it joins its fellow. It is immediately anterior to this junction that the communication exists between the lateral ventricles, termed the *foramen of Monro*.

Divide the fornix transversely at its middle: it seems to consist of two flat chords in apposition, and cohering internally; reflect the two portions: the reflection of the posterior shews upon its white under surface oblique ridges called the *lyra Davidis*, and exposes the *velum interpositum*, a reduplicature of pia mater, extending across from one plexus chorioïdes to the opposite. Two veins pass back longitudinally in the velum, they are called the *venæ Galeni*. Raise and reflect the chorioïd plexus and velum interpositum. The entire convex upper surface of either thalamus is now seen, having an *anterior tubercle*, and sloping inwards to meet its fellow; convex anteriorly, so as to form, with its fellow, two sides of the *foramen commune anterius*, or *iter ad tertium ventriculum*, a prolongation downwards of the canal of Monro.

On gently separating the thalami, their internal union by the grey matter of the *commissura mollis* is seen, and may be broken through. The slightly con-

cave surface below is the floor of the *third ventricle*, the tentlike roof of which was formed by the convergence of the thalami to meet at the soft commissure. The third ventricle is about an inch and an half in length and three lines in breadth. Separate at its fore part the *anterior crura* of the fornix, which are bending downwards; before them is seen at this interval a transverse chord, the *commissura anterior cerebri;* below which an aperture, the *iter ad infundibulum*, leads into a short *funnel* of grey matter, that terminates in a larger mass apparently of the same substance, lodged in the sella turcica, and called the *pituitary gland*. At the back part of the third ventricle is another outlet, the *iter ad quartum ventriculum*, opening underneath another transverse chord, the *commissura posterior*. Above the commissura posterior, two white fasciculi from the upper and inner margin of the thalami pass downward and backward, to be attached to the base of the *pineal gland*, an oval yellowish grey substance half an inch in length, placed immediately behind the commissura posterior; its upper surface adhered to the velum interpositum. On crushing the pineal gland betwixt the finger and thumb, it is found to contain gritty particles. The pineal gland rests between the uppermost two of four hemispherical bodies, called *tubercula quadrigemina*, which project from a plane slanting obliquely downwards and backwards.

Cut through the pes hippocampi on either side, and carry the incision forward through the brain; divide the commencement of the hippocampus major, and carry the incision backward through the brain; and remove the lateral portion thus separated on either side.

Raise the brain from the fore part: a greyish oval mass fills the cribriform plate of the ethmoïd bone on each side of the crista Galli, from which a flat chord passes backwards between the pia mater and arachnoïd membrane: this is the *first* or *olfactory nerve;* divide it on the ethmoïd bone, and trace it backward to its origin by three white filaments from the under part of the corpus striatum.

From the foramen opticum, trace backward the second pair of nerves, the *optic*, to their union above the sella turcica: their union is called the *commissura nervorum opticorum.*

Divide the nerves at the optic foramina, and continue to raise what remains of the brain. Behind the commissura nervorum opticorum, the infundibulum passes down to the pituitary gland. On its division, a lozenge-shaped grey surface is seen at the base of the brain, with a fissure in the middle, on either side of which a small white eminence is seen, called the *corpus albicans.* The centre of this grey surface belongs to the substance, which forms the floor of the third ventricle. This surface is cribriform from the passage of numerous vessels: it is enclosed before and laterally by the *tractus optici*, as those flattened white bands are called, which are incurvated backwards from the commissura nervorum opticorum. It is enclosed behind by two fluted and cylindrical processes of medullary matter called *crura cerebri,* which descend obliquely backwards and inwards; from the inner margin of the crus cerebri the *third* nerve or *motor oculi* arises, thence passing outward and forward to its sheath in the dura mater.

Now remove all the cerebrum above the optic tha-

lami, crura cerebri, and tubercula quadrigemina. A slender nerve, the *fourth*, is seen to rise from the white and thickened edge of what is called the *Vieussenian valve*, just below the tubercula quadrigemina, to turn round the crus cerebri, and then to reach the dura mater, which it perforates. The tractus opticus seems to terminate in the back part of the thalamus nervi optici; a greyish nodule is formed upon it just before it disappears, called the *corpus geniculatum externum;* a second similar nodule is found between the posterior margin of the crus cerebri and the tubercula quadrigemina called the *corpus geniculatum internum*.

The process of dura mater, which supports the posterior part of the cerebrum, is called the *tentorium cerebello superextensum:* it is attached before to the posterior clinoïd processes, laterally to the edge of the pars petrosa, to the posterior angle of the parietal bone, and to the transverse sinuosity of the occipital: its surface is inclined upwards towards the oval opening, by which it transmits the crura cerebri and Vieussenian valve. The superior longitudinal sinus divides, where the superior margin of the falx cerebri joins the tentorium, into the two *lateral sinuses*, the right generally the larger, which are at first contained in the margin of the tentorium, and subsequently pass down in a groove of the temporal parietal and occipital bones to the foramen lacerum in basi cranii, where each sinus emerges under the name of *internal jugular vein*.

The inferior longitudinal sinus and venæ galeni meet at the junction of the falx with the unattached margin of the tentorium: a sinus leads from thence to the division of the superior longitudinal sinus: it is called

the *fourth sinus*, or *torcular Herophili*. A small sinus may be seen creeping backward in the dura mater on the pars petrosa to join the lateral sinus: it is called the *superior petrous sinus*.

The *circular sinus* is disposed around the sella turcica, and opens into the *cavernous sinus*, which is contained in a reflection of the dura mater from the edge of the sella turcica to the greater ala of the sphenoïd bone; and this again communicates with the lateral sinus near its termination, by means of the *inferior petrous sinus*, which passes downward in a groove at the edge of the basilar process of the sphenoïd and occipital bases. To conclude the account of the processes and sinuses of the dura mater, a *falx cerebelli* is found in the median plane below, containing a *sinus* within its edge, which opens into the torcular Herophili; finally, four sinuses, the *anterior* and *posterior occipital sinuses*, are disposed around the margin of the foramen magnum, of which the posterior are often of great size, unite with the anterior, and open into either lateral sinus.

Remove the occiput by sawing through the bone vertically behind the petrous portion of the temporal bone: you observe the *laminated* surface of the *cerebellum*, its *hemispheres*, and the narrower central part, the *pars media*, or *vermiform processes*; the *horizontal fissures* on either side, out of which bands of medullary matter emerge, and meeting before, become a broad and thick arch, the *pons Varolii*, thrown over the converging crura of the cerebrum; the *Vieussenian valve*, consisting of a central slip of cineritious matter longitudinally and transversely furrowed, and margined by two rounded pillars of medullary matter, attached to the middle and fore part of the cerebellum.

Introduce a probe into the iter à tertio ad quartum ventriculum, and cut through the valvula Vieussenii longitudinally: the probe is seen in the cavity of the *fourth ventricle*, which appears bounded before by the posterior surface of the pons Varolii, above by the Vieussenian valve, laterally by the peduncles of the cerebellum, and behind by the lower vermiform process.

The pars media seems prominent anteriorly both above and below the Vieussenian valve: the upper half is called the *superior vermiform process:* the lower, the *inferior*. A plexus of vessels like the chorioïd is seen entering at the lower part of the fourth ventricle.

Cut through an hemisphere of the cerebellum, parallel to and at three quarters of an inch distance from the median plane; the appearance produced is termed the *arbor vitæ;* a central stem of white matter is seen, from which branches arise, that divide and subdivide, and are finally clothed with a thin layer of cineritious matter. In the white stem, the section of a curiously folded capsule of grey matter containing medullary matter is seen, termed the *corpus fimbriatum*.

The numerous nervous filaments, which emerge from either side of the pons Varolii by a broad external and a narrow internal and anterior fasciculus form the *fifth pair;* they pass to an oval aperture in the dura mater upon the pars petrosa, just below the edge of the tentorium.

The conical mass of white matter, which descends from the pons Varolii, is called the *medulla oblongata:* its surface is subdivided by fissures nearly longitudinal into the following eminences. On either side of the median fissure is seen the *corpus pyramidale anterius;* next, an oval eminence, the *corpus olivare*, which con-

tains a *corpus fimbriatum;* thirdly, the *corpus restiforme*, or *inferior peduncle of the cerebellum;* and finally, between this and the posterior median furrow, the *corpus pyramidale posterius.*

The *sixth* nerve rises from the furrow between the inferior margin of the pons Varolii, and the corpus pyramidale: it perforates the dura mater an inch below the posterior clinoïd process.

The *seventh* nerve consists of the *portio dura*, or *facial*, and *portio mollis* or *auditory nerve.* The portio dura rises from the hollow between the corpora olivaria, restiformia, and the inferior margin of the pons. To shew the origin of the portio mollis, raise the inferior vermiform process; a longitudinal furrow is seen upon the layer of grey matter, which forms the anterior surface of the fourth ventricle; from this furrow four or five white lines pass outwards: the whole appearance is termed the *calamus scriptorius;* the white lines are the origin of the portio mollis, which forms a thick soft chord turning over the margin of the corpus restiforme, and subsequently passing externally to and below the portio dura to the foramen auditorium *internum.*

The *eighth* nerve consists of three divisions on either side: about twenty-five filaments arise from the anterior surface of the corpus restiforme, which pass towards the foramen lacerum in basi cranii. Of these, the four or five uppermost form the *glosso-pharyngeal nerve*, the remainder the *nervus vagus.* Another nerve, the *spinal accessory*, is seen to ascend from the foramen magnum to join the two former, and thus to complete the eighth pair.

The *ninth* pair, or *motor linguæ*, the last cerebral nerve, arises from the furrow between the corpus

pyramidale anterius and the corpus olivare by about fifteen filaments, which converge to perforate the dura mater at the foramen condyloïdeum anterius.

You may now remove the bony arches of the cervical vertebræ, so as to be enabled to examine the upper part of the *spinal chord*, its membranes, and the mode of origin of its nerves.

You observe, that the dura mater is continued along the spinal canal, but does not form its periosteum; it is here termed *theca vertebralis:* that the *arachnoïd membrane* and *pia mater* are prolonged downwards, investing the flattened and narrowed continuation of the medulla oblongata, which constitutes the *spinal chord;* that reflected slips of the arachnoïd membrane, called *ligamenta dentata*, extend laterally from the spinal chord to the theca vertebralis opposite to each vertebra, being half an inch in breadth at the side of the spinal chord, pointed where they reach the theca; that the spinal chord has an anterior and a posterior median furrow, and two lateral furrows before and behind; that the spinal nerves arise by two sets of fasciculi, one from the anterior lateral, the other composed of fewer and coarser fasciculi from the posterior lateral furrow; that these converge on either side of a ligamentum dentatum, to perforate the theca laterally and near each other; that the *spinal accessory* nerve rises by twenty filaments or more from the spinal chord in the neck for its first three or four inches behind the ligamenta dentata; that the spinal nerves are thirty-one in number on either side; that each spinal nerve is called after the bone, under which it makes its exit, as *sub-occipital*, *first cervical*, and the like; and finally, were you to complete the removal of the bony arches, you

would observe that the spinal chord is broadest at the lower part of the neck, and lower part of the back, where the great nerves of the extremities arise; that it tapers to a point, and terminates opposite to the first lumbar vertebra; that the nerves are more oblique during their course in the theca as their origin is more remote from the brain; and finally, that from the first lumbar vertebra to the os coccygis, the theca is filled entirely by obliquely descending nerves, termed the *cauda equina*.

On making a transverse section of the spinal chord, you observe in either lateral part a pentagonal portion of grey matter.

M. Majendie has ascertained by experiments upon living animals, that the posterior roots of the spinal nerves are connected with sensation, and the anterior with voluntary motion; each spinal nerve, therefore, contains all the elements necessary for the supply of any part. Hence the distribution of the spinal nerves is simpler than that of the cerebral nerves generally, which for the most part are exclusively sentient or voluntary.

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§ II. DISSECTION OF THE NERVES OF THE FACE.

Divide the integuments over the anterior margin of the mastoïd process of the temporal bone; a cutaneous nerve, the *nervus posterior auris*, is found, often exactly interposed between the skin and the tendon of the sterno-cleido-mastoïdeus. Separate the parotid gland

from the margin of the mastoïd process; opposite to the middle of which, at the depth of an inch or more, the trunk of the PORTIO DURA of the seventh nerve may be exposed. The same method is used in surgery to expose the portio dura for division. With reference to this operation, you will remark that the arteria posterior auris emerges between the mastoïd process and the parotid gland, in the separation of which it follows that the knife should be cautiously used.

The portio dura having escaped through the foramen stylo-mastoïdeum, passes obliquely downwards, forwards, and outwards, between the stylo-hyoïdeus and biventer maxillæ inferioris, to enter the parotid gland. During this passage, at the middle of which the preceding dissection has exposed the nerve, it gives off,

I. The *nervus stylo-hyoïdeus*, which supplies the stylo-hyoïdeus, and is connected with the sympathetic.

II. The *nervus digastricus*, which supplies the muscle of the same name, and connects itself with the superior laryngeal nerve.

The trunk of the portio dura, on entering the parotid gland, divides into two branches, of which the upper is the larger. These again subdivide: their branches issue from the anterior margin of the parotid, and diverging occupy the side of the face and head: in their course they are reciprocally united by large branches: so that the distribution of the nerve has the appearance of an extensive plexus, which is termed the *pes anserinus*. The five uppermost branches are slender: these are,

III. The *nervus jugalis primus*, or *temporalis posterior*.

IV. The *nervus jugalis secundus.*

V. The *nervus jugalis tertius.*

VI. The *nervus orbitalis superior*, or *jugalis quartus.*

VII. The *nervus orbitalis inferior*, or *jugalis quintus.*

Branches of the four upper *nervi jugales* coalesce with branches of the frontal nerve of the fifth; branches of the lowest coalesce with branches of the infraorbital nerve and the nervus cutaneus malæ.

The following nerves are the largest branches of the portio dura, and run parallel to the duct of the parotid gland. Some of their branches coalesce with twigs of the infra-orbital and buccinator nerves.

VIII. *Nervus facialis superior.*

IX. *Nervus facialis medius*, or *magnus.*

X. *Nervus facialis inferior.*

The remaining nerves are slender, and are derived from a long branch of the portio dura, which descends behind the margin of the branch of the jaw.

XI. *Nervus facialis inferior.*

XII. *Nervus marginis maxillæ inferioris.*

XIII. *Nervus*, or *nervi subcutanei colli.*

Branches of the eleventh and twelfth coalesce with the mandibulo-labialis; of the thirteenth, with the cutaneous branches of the second cervical nerve.

The portio dura supplies the cutaneous muscles of the face entirely, as well as furnishes branches to the skin. An ingenious theory by Mr. Bell supposes that this nerve excites the muscles of the face on some occasions only, as in breathing, in the expression of passion, and the like; and *not on others*, as in the pre-

hension of food. Some experiments, which I have made, tend to prove that the portio dura is the *common* and *exclusive motor nerve* of these muscles upon *all* occasions; when the portio dura is divided on both sides in a rabbit, dog, or ass, the muscles of the face are *totally* paralyzed; it is needless to remark, that no paralysis of these muscles ensues on the division of other nerves.

In following the preceding branches, six superficial branches derived from the *fifth pair* are met with.

I. The *nervus frontalis* is a part of the first division of the fifth: to *expose* it, feel for the superciliary notch or foramen, which is situated at about a third of the frontal margin of the orbit from its inner extremity; divide the skin transversely over this notch at the upper or lower edge of the eyebrow. The frontal nerve emerges at this notch or foramen, and spreads its branches over the forehead and temple.

II. The *infra-orbital nerve* is a part of the second division of the fifth; to *expose* it, feel for the infra-orbital foramen, which is situated midway between the alveolar process of the first bicuspis and the orbital margin of the superior maxillary bone, and divide the skin obliquely over it. For the *simple division* of this nerve, a sharp bistory introduced from within the lip, may be directed with sufficient certainty to the aperture in the bone, a probe being pressed against the foramen as a guide. The infra-orbital nerve having emerged from its canal, divides into six branches, one to the lower eyelid, two to the nose, three larger distributed to the cheek and lip.

III. The *nervus cutaneus malæ* is a small branch

derived from filaments of the first and second divisions of the fifth, that unite in the orbit; it commonly emerges through the malar foramen upon the cheek.

IV. The *nervus mandibulo-labialis* is a part of the third division of the fifth; to *expose* it, make an *oblique* incision through the skin covering the foramen mentale, which is situated midway between the margin of the alveolar process of the second bicuspis and the base of the jaw. The nerve, on emerging, divides into a *smaller outer* and a *larger inner branch* distributed to the muscles and integuments of the under lip.

V. The *buccinator nerve* is a branch of the third division of the fifth: it is to be found upon the buccinator muscle within the upper and fore part of the masseter, whence it descends obliquely forward; its branches are distributed to the buccinator and other muscles reaching the angle of the mouth, to its mucous membrane and the small glandular bodies termed glandulæ buccales.

VI. The *nervus temporalis superficialis*, or *auricularis*, is another branch of the third division of the fifth: it emerges from within the parotid at the root of the jugum, having given off two principal branches to join the upper part of the trunk of the portio dura, besides smaller twigs; it is distributed upon the temple in a larger anterior and a smaller posterior branch.

These superficial branches of the fifth are distributed to all the cutaneous muscles, and to the skin of the face. The theory of Mr. Bell, above alluded to, supposes that these nerves are the common voluntary nerves of the muscles of the face, and likewise nerves of cutaneous sensation. My own experiments tend to

prove that these nerves are exclusively *nerves of sensation**.

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§ III. DISSECTION OF THE ORGAN OF VISION †, AND OF THE NERVES CONNECTED WITH IT.

Prepare to dissect on one side the membranes, muscles, and substance of the eyeball; on the other, the nerves connected with these parts.

I. *Of the Apparatus, which defends the surface of the Eye, and moves the Eyeball.*

Saw through the os frontis to the outside of, and half an inch from its internal angular processes into both orbits, and again at the outer angle of each orbit, and by a sharp blow with a hammer, break away the intercepted portions of bone with the adhering orbital plates.

On clearing away the fat, the *lacrymal gland* is found to occupy the outer and upper part of the orbit, oval, flattened, and in appearance not unlike a salivary gland. Draw the eyelids away from the eye, you notice that they are lined by a mucous membrane, the *tunica conjunctiva*, which is afterwards reflected over the anterior surface of the eyeball, to about half an inch in every direction from the edge of the cornea, which it covers; at the upper and outer part of its line of reflection, five or six small orifices may be observed

* Anatomical and Physiological Commentaries, Parts 1 and 2.

† The student will find this dissection illustrated by a Plate of the Eye, now published by Messrs. Burgess and Hill.

in a row, into which bristles may be passed. These are the orifices of the *ducts* of the lacrymal gland.

The *caruncula lacrymalis* is a vascular fleshy tubercle at the inner canthus of the eye, covered by the tunica conjunctiva, before which the margins of the eye-lids meet, each having a capillary aperture. These apertures are called *puncta lacrymalia*, into which bristles may be introduced, and passed along two tubes behind the tendo oculi into the *lacrymal sac*. The eye-lids are supported upon two narrow portions of cartilage, called *tarsal cartilages*, from which the skin and orbicularis palpebrarum may now be dissected, so as to exhibit their dimensions. Their opposed edges are slightly grooved, and deeper before than behind, so as to form a channel for the tears during sleep. The eye-lashes grow from their outer margin, and along their inner, the ducts of very numerous sebaceous glands open, which ducts are two or three lines in length, and are to be distinguished by their whitish contents between the tunica conjunctiva and the tarsal cartilages.

There are seven muscles within the orbit, each about half an inch in breadth.

1. The LEVATOR PALPEBRÆ SUPERIORIS *rises* from the superior margin of the foramen opticum, and is *inserted* into the upper tarsal cartilage: its name denotes its *use*: it is the central and uppermost muscle of the seven.

2. The OBLIQUUS OCULI SUPERIOR *rises* from the margin of the foramen opticum immediately to the inside of the preceding; it passes forward, upward, and inward: its round tendon plays through a membranous loop (which is attached to the inner part of

the frontal margin of the orbit), and is then reflected backwards, downwards, and outwards, to be *inserted* into the sclerotic coat of the eye behind its vertical axis and the insertion of the rectus superior.

3. The OBLIQUUS INFERIOR OCULI is found on raising the eye; it *rises* from the orbital plate of the superior maxillary bone, and, passing outward and backward, is *inserted* into the outside of the sclerotic, behind its transverse horizontal axis, and the insertion of the rectus externus.

The obliquus superior draws the eye forwards and directs it downwards and outwards. The obliquus inferior draws the eye forwards and directs it upwards and outwards. These muscles are intended to prevent the gradual retraction of the eye into its socket by the remaining muscles.

4, 5, 6, 7. The four RECTI rise from around the margin of the foramen opticum; they advance forward, diverging in such a manner as to enclose the globe of the eye; that above is called the RECTUS SUPERIOR, or ATTOLLENS OCULI; that below, the RECTUS INFERIOR, or DEPRESSOR OCULI; that without, the RECTUS EXTERNUS, or ABDUCENS OCULI; that within, the RECTUS INTERNUS, or ADDUCTOR OCULI. They are each inserted by a thin, broad tendon into the sclerotic, half an inch from the margin of the cornea. They are employed singly, or in combination, to direct the eye each way, and they would gradually retract the eye in the socket but for the resistance of the obliqui.

An aponeurosis extends from the recti tendons to the margin of the cornea, which closely coheres with,

but may be dissected off from the sclerotic. This aponeurosis is called the *tunica albuginea* of the eye.

2. *Of the Globe of the Eye.*

When the preceding parts have been removed, the globe of the eye remains attached to the back part of the orbit by the optic nerve, which perforates the posterior surface of the eye within and at two lines distance from its longitudinal axis.

The external dense white coat of the eye is called the *sclerotic;* into its fore part the transparent *cornea*, a segment of a smaller sphere, is let in: the substance of the cornea is laminated.

Pinch up the sclerotic parallel to, and at three lines distance from the cornea, and cut out the portion; a dark coloured and delicate membrane is seen within, called the *chorioïd* tunic of the eye: dissect off in this manner the sclerotic coat from the outer half of the eye.

The outer surface of the chorioïd, upon which you notice the longitudinal course of the ciliary nerves, is tinged with a dark coloured mucus called the *pigmentum nigrum*, that has transuded from within. Delicate semicircular and parallel ridges upon the chorioïd, the horns of which look from the cornea, are formed by veins called *vasa vorticosa*. Towards the margin of the cornea, the chorioïd appears to become firmer in its texture, and adherent to the margin of the sclerotic; this thickened and adhering part is called the *corona ciliaris*, or *ligamentum ciliare*.

The dissection of the eye is now to be continued in a shallow vessel under water. Tear the chorioïd care-

fully through with the assistance of two blunt forceps; its inner surface appears black with the copious secretion of the pigmentum nigrum: its inner surface, which furnishes this secretion, is called the *tunica Ruyschiana*.

The *retina* is the thin and pulpy tunic, which is thus exposed: it is continued forward to within from two to three lines of the margin of the cornea. The retina is subdivisible into three layers: the *outer* is a *cellular tunic*, recently discovered by Dr. Jacob, readily separable by gentle pressure with the handle of the knife; the *second* is of *grey nervous matter*, continuous with the trunk of the optic nerve; the *third* and *inner*, is a very delicate *vascular membrane*, from which the nervous matter is easily scraped. The retina has a small perforation exactly in its centre, around which a yellow zone is traced. This appearance may perhaps be shewn in the present stage of the dissection as described, but is better seen on making a clean transverse section of an undisturbed eye, and viewing the foramen through a segment of the vitreous humour.

Now remove the eye from the water, under which the recent dissection has taken place, and divide the sclerotic chorioïd and retina for the remaining part of the circumference of the eye, allow the humours to drop out, and examine the inner surface of the margin of the chorioïd: it appears to be folded in plicæ converging towards the centre of the cornea. These plicæ are upon the under surface of the corona ciliaris; they are called the *ciliary processes;* their anterior margins project half a line beyond the corona ciliaris.

Before the unattached extremities of the ciliary processes, the *iris* is attached to the corona ciliaris. The *iris* is a delicate layer of membrane, is held out

vertically behind the cornea, and has a central circular aperture called the *pupil*. The iris is highly vascular, is elastic, and contains circular irritable fibres at its margin: its posterior surface secretes pigmentum nigrum, and is called the *uvea*. The inner surface of the ciliary processes secretes the same substance.

The greater part of the humours of the eye, which fell out on the entire division of the sclerotic, consists of a mass apparently of the consistence of jelly, in the fore part of which a small lens of firmer substance seems embedded. The jelly-like mass is the *vitreous humour:* it is, in truth, a liquid contained in a transparent capsule termed the *hyaloïd membrane*, from which innumerable fine processes pass inwards, forming a series of cells which contain the humour. Near the margin of the lens the impression of the ciliary striæ is observable upon the hyaloïd membrane.

The *crystalline humour*, which is imbedded in the front of the vitreous, is a double convex lens; the posterior surface is more prominent than the anterior. It is confined in its place by the following mechanism: as the hyaloïd membrane approaches its margin, it splits into two layers, one of which passes behind the crystalline, the other terminates upon its fore part; a sacculated canal exists between the two layers of the hyaloïd membrane around the margin of the lens: this is termed the *canal of Petit;* it is readily inflated by means of the blow-pipe applied to a punctured orifice. The lens itself has its proper *capsule*. The substance of the lens is of unequal density, its outer layers are nearly gelatinous, its nucleus a tough transparent solid.

The liquid, which escaped on completing the divi-

sion of the coats of the eye, is termed the *aqueous humour:* it is contained in a concavo-convex chamber, bounded anteriorly by the cornea, behind by the lens, and margined by the corona ciliaris: the iris floats in the aqueous humour, and divides its chamber into an anterior and posterior recess, which communicate at the pupil.

3. *Of the Nerves of the Orbit.*

To trace the nerves of the orbit, the dissection must begin in the cranial cavity, at the points at which the second, third, fourth, fifth, and sixth nerves, disappear within the dura mater.

The *second nerve* is traced directly to the foramen opticum.

The *fourth nerve* is readily followed through a long canal in the dura mater, which conducts this nerve in a direction forwards, and rather obliquely upwards, to the foramen lacerum superius.

The *third nerve* is readily traced through a canal in the dura mater, which leads it forward to the foramen lacerum; but horizontally, so that the fourth crossing it obliquely is placed finally above the third.

On cutting through the dura mater, which covers the *fifth nerve*, its numerous filaments seem all to enter the inner concave margin of a reddish grey body, flattened, oblong, and externally convex, called the *Gasserian ganglion*. From the convex margin of this ganglion, three large fasciculi, the *first*, *second*, and *third divisions* of the *fifth*, emerge. The anterior and smaller is the *first* or *ophthalmic division:* its course is nearly parallel to that of the fourth nerve, but its in-

clination upwards somewhat greater; so that in the foramen lacerum orbitale these two nerves come into contact, and cohere.

Thus the third pair is contained in a proper canal in the upper part of that layer of dura mater, which laterally contains the fourth nerve and the ophthalmic division of the fifth: but this layer of dura mater is the outer wall of the cavernous sinus already spoken of.

Cut open the cavernous sinus: the last turn of the internal carotid artery is seen against its inner surface, and crossing this on its outside the *sixth nerve* is observed to be contained within the cavity of the sinus, so as to lie considerably below but parallel to the third nerve. Where the sixth nerve crosses the carotid artery, it gives off two reddish branches, which descend upon the vessel in the form of a plexus, being the origin of the *sympathetic nerve*.

The relative place of the third, fourth, and sixth nerves, and orbital division of the fifth, in their course from the margin of the dura mater to the foramen, is shewn in the second plate.

Within the orbit the *fourth* nerve crosses over the optic and terminates in the obliquus superior oculi.

The *sixth* passes outwards below the fifth and fourth, and external to the third, and terminates in the rectus externus oculi.

The *first division of the fifth* subdivides into,

I. The *frontal branch*, which runs immediately below the periosteum of the orbit towards the superciliary foramen, and terminates in a larger portion, the *nervus frontalis* already described, and a smaller part the *nervus supra-trochlearis*, which is internal to the

frontal, and ascends to be distributed to the parts situated at the inner margin of the orbit.

II. The *nervus lacrymalis*, of which there are generally two slender filaments, one of which terminates in the gland, while the other is prolonged beyond it, and gives off that branch, which joined by a filament from the infra-orbital nerve of the second division of the fifth, forms the nervus cutaneus malæ.

III. The *nervus nasalis*, which passes obliquely inwards and forwards between the optic nerve and the rectus superior, and gives off at this point *one branch* to the *lenticular ganglion;* secondly, *ciliary branches*, which perforate the sclerotic directly and pass on to the iris between the sclerotic and chorioïd; and, lastly, terminates by division into the *nervus ethmoïdalis* and *nervus infra-trochelaris:* the former of which re-enters the cranial cavity at the foramen orbitale internum anterius, to leave it again through the cribriform lamella and be distributed upon the fore part of the septum nasi: the latter is distributed upon the parts adjoining the inner canthus of the eye.

The *third nerve* divides into two branches; the upper of these is the smallest, and subdivides into two filaments, *one* of which is distributed to the levator palpebræ superioris, the other to the rectus capitis superior: the *lower* of the two primary branches of the third gives off one or two twigs, on which the lenticular ganglion is formed, and ends in three filaments; one distributed to the rectus internus, one to the rectus inferior, the third to the obliquus inferior.

The *lenticular ganglion* is a grey triangular body somewhat more than a line in thickness, formed upon branches of the third joined by a branch from the ner-

vus nasalis of the fifth: the *ciliary nerves* are derived in part from this ganglion, in part directly from the nervus nasalis: these are through subdivision about sixteen in number before they perforate the sclerotic; six above, ten below: they perforate the sclerotic about three lines from the axis of the eye, and pass forward between that membrane and the chorioïd to supply the iris.

It is obvious from their distribution that the third, fourth, and sixth nerves are voluntary nerves. I ascertained that the fifth is the nerve, on which the sensibility of the surface of the eye depends, by dividing this nerve within the cranial cavity of a pigeon; upon which the cornea and eyelids lost their feeling: and by corresponding experiments made both upon pigeons and cats, I have ascertained that the third nerve is the medium through which contraction of the iris is produced. M. Majendie has found that division of the fifth nerve within the cranial cavity of a rabbit produces seemingly immediate loss of vision followed by inflammation and ulceration of the eye. In the kitten I have found slight opacity of the cornea follow this experiment, in addition to the loss of feeling; but vision in this animal seems otherwise unimpaired by the division of the fifth.

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§ IV. DISSECTION OF THE SECOND DIVISION OF THE FIFTH NERVE.

It is not without great difficulty that the second and third divisions of the fifth and their branches are followed in their passage through the canals of adult

crania. When you wish to dissect these nerves with any degree of minuteness, it is expedient that you steep the head for several days previously in dilute muriatic acid; which at the same time hardens the nervous substance, and softens the bone to that degree, that it may be cut with a knife.

The *second division* of the fifth enters the foramen rotundum of the sphenoïd bone: if you remove the upper part of this short canal, and the bone immediately beyond, the nerve is seen to cross the spheno-maxillary fossa and enter the posterior opening of the infra-orbital canal. In this short space it gives off,

I. The *nervus cutaneus malæ*, which passing forward enters the orbit at its external fissure, receives a branch from the lacrymal nerve, passes along the floor of the orbit, and either emerges at the foramen in the malar bone upon the cheek, or is distributed to the upper eyelid.

A large trunk next descends from the infra-orbital nerve, which divides into two branches; or these, but more rarely, arise separately. A ganglion, called the *ganglion of Meckel*, is generally formed upon these two branches a few lines below the infra-orbital nerve; and from this ganglion are derived,

II. The *vidian nerve*, which is reflected backwards to the pterygoïd canal, and gives off two, three, or four *rami nasales priores*, which pass inwards and are distributed upon the mucous membrane of the nostrils, then enters the pterygoïd canal, and gives off two or three *nervi nasales superiores posteriores*, of which one descends obliquely along the septum and dips through the foramen palatinum anterius to the fore part of the

palate; on emerging from the pterygoïd canal the vidian nerve divides into two final branches as it re-enters the cranium on the outside of the carotid artery. One of these is called the *superficial* or *petrous branch;* its course lies along the vidian groove of the temporal bone, which conducts it to a canal ending in the aqueduct of Fallopius, where the nerve joins the portio dura. The other branch is called the *ramus profundus*, it passes upon the artery, and associates itself with the descending branch of the sixth, forming a second origin of the sympathetic.

III. The *nervus palatinus*, which descends along the canal that leads to the foramen palatinum posterius, in three portions, termed the *nervus palati major prior*, the *nervus palati minor posterior*, and the *nervus palatinus minimus exterior*. From the first the *nervi nasi inferiores* are derived. These three nerves are spread out in succession upon the palate, the velum pendulum palati, uvula, and tonsils.

IV. The *nervus alveolaris* descends along the posterior surface of the os maxillare superius in one or two fasciculi, the *anterior* of which supplies the antrum and the alveoli of the upper molares, the *posterior* is distributed to the buccinator and membrane of the mouth.

The second division of the fifth reduced by the loss of the preceding branches enters the infra-orbital canal, from which it distributes the *nervi dentales priores*, and then emerging upon the cheek terminates as described in the dissection of the nerves of the face.

§ V. DISSECTION OF THE THIRD DIVISION OF THE FIFTH NERVE.

The third division of the fifth appears the largest, looking on its superior surface alone, all the fibres of which are derived from the Gasserian ganglion. On raising the nerve it is seen that an additional fasciculus of a line in breadth passes below the ganglion without mingling with its substance and associates itself exclusively with the third division. This flat fasciculus is the same which arises apart from and internal to the trunk of the nerve on the side of the Pons Varolii. Beyond the ganglion its filaments interlace with those of the larger portion.

The entire third division of the fifth thus constituted passes through the foramen ovale, the anterior margin of which is to be cut away with a view to expose the distribution of the nerve, which immediately gives off the following branches. It is expedient in addition to saw through the lower jaw before the insertion of the masseter, leaving it otherwise attached.

I. The *ramus massetericus*, which passes obliquely outwards and downwards over the pterygoïdeus externus, and between the condyloïd and coronoïd processes of the lower jaw; it gives a twig or two to the articulation of the jaw, and is then distributed through the substance of the masseter muscle.

II. The *ramus temporalis*, which passes outwards and upwards, and is distributed to the temporal muscle: this nerve is frequently derived in two fasciculi from the trunk of the third division.

III. The *ramus buccinatorius*, which passes obliquely forward over the pterygoïdeus externus, which it supplies with nerves: it sends one or two twigs to the temporal, and then descends between the masseter and buccinator muscle upon the cheek, where its distribution has been already described.

IV. The *nervus pterygoïdeus*, smaller than the preceding, which supplies the pterygoïdeus internus and the circumflexus palati.

V. The *nervus temporalis superficialis* or *auricularis*, which ascends obliquely outwards passing behind the branch of the jaw; its course has been already described: some of its branches coalesce with branches of the portio dura.

VI. The *nervus mandibulo-labialis*, which descends obliquely forwards between the two pterygoïd muscles, giving off the *nervus mylohyoïdeus*, which passes along the outer margin of the insertion of the mylohyoïdeus to the chin, and distributes *branches* to the mylohyoïdeus and biventer, and to the sublingual and submaxillary glands.

VII. The *nervus gustatorius*, which passes downwards and forwards on the outside of the circumflexus palati, where it is joined by the chorda tympani of the portio dura; it gives a few filaments to the tonsils and the pharynx, reaches the side of the tongue, and gives off two or three branches, which descend and directly form the *submaxillary ganglion*, from which six branches and upwards enter the submaxillary gland. The nerve finally passes forward between the styloglossus and the sublingual gland, giving twigs to each and to the membrane of the mouth, and to the gums and to the genioglossus, besides two or three branches

which coalesce with branches of the ninth nerve; the nerve is finally and principally distributed upon the surface of the tongue.

The distribution of the third branch of the fifth nerve has this peculiarity; that it supplies branches to muscles which derive nerves from no other source, viz. the masseter, the temporal, the pterygoïd muscles, and the circumflexus palati; it is therefore clear that the third branch of the fifth is in part a voluntary nerve; but the third branch of the fifth has associated with it that smaller fasciculus, which does not join in forming the Gasserian ganglion. It occurred to me that the latter portion might be exclusively distributed to the muscles in question, and by dissection I ascertained that this was the case. I subjoin a drawing of a repetition of the dissection I allude to.

A is meant to represent the pterygoïdeus externus.

B The pterygoïdeus internus.

C The temporal muscle.

D The masseter.

K The circumflexus palati.

A portion of the base of the skull, including the foramen ovale, was removed, the part having been previously macerated in a solution of muriatic acid.

E E represent the two portions of the Gasserian ganglion which was divided. The portion belonging to the third division of the fifth is reversed, and drawn backwards to leave exposed,

F, the inferior smaller fasciculus of the nerve: it is seen to be distributed to the five muscles above named, along with branches from the ganglionic portion. It appeared unnecessary to letter any of these branches excepting,

L, the nervus buccinatorius, which is represented as giving off two branches to the pterygoïdeus externus and one to the temporal muscle, and finally turning over the margin of the former towards the buccinator muscle. I have satisfied myself by repeated dissections that *the portion of the nerve, which passes onwards to the buccinator muscle and membrane of the mouth, does not contain any filaments from the smaller fasciculus: those elements of the buccinator nerve, which are derived from the latter source, are consumed in its temporal and pterygoïdeal branches.* Since ascertaining the preceding anatomical facts, I find that they were known to Palletta*, with the exception of that marked in Italics.

Thus it appears, that in the only case, in which muscles are supplied by the fifth nerve alone, a peculiar and separate fasciculus, which has no connection with the Gasserian ganglion, contributes to the filaments so employed: and that this portion contributes no filaments to muscles, which receive branches from other nerves. But the greater number of the branches of the ganglionic portion of the fifth are proved by direct experiment to be merely sentient nerves; it is therefore probable that those branches, which enter the five muscles above named are likewise of this kind: but if these nerves are sentient, it is probable that the remaining filaments are voluntary; namely, those which belong to the smaller fasciculus: a conclusion established beyond a doubt by the analogy of the two parts of the spinal nerves.

In Plate 2 the gustatory nerve Z is drawn from its proper place in order to shew the manner in which it

* Scriptores Neurologici Minores.

is joined by the chorda tympani. The roman numerals mark the different cerebral nerves; the number from which the name of each nerve is taken, is employed to denote it.

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§ VI. DISSECTION OF THE REMAINING NERVES OF THE TONGUE.

Remove entirely the detached portion of the lower jaw, and dissect the biventer maxillæ inferioris and stylohyoïdeus: the *ninth nerve*, which has emerged at the foramen condyloïdeum anterius, and in its course downwards and outwards has received filaments from the par vagum, spinal accessory, sympathetic, and upper cervical nerves, is found immediately within the stylohyoïdeus passing forwards towards the tip of the tongue. Opposite to the angle of the jaw, the ninth nerve gives off the *nervus descendens noni;* which descends within the fascia cervicalis superficialis, is joined by a branch from the first and from the second cervical nerves in such a way as to form an arch, the convexity of which looks towards the chest, and from which are derived branches to the omohyoïdeus, sternohyoïdeus, sternothyreoïdeus, and thyreohyoïdeus, as well as to the phrenic nerve.

The continued trunk passes forwards between the mylohyoïdeus and hyoglossus, and distributes its branches to the mylohyoïdeus, geniohyoïdeus, geniohyoglossus, styloglossus, and lingualis: some of its branches coalesce with branches of the gustatory.

On dividing this nerve the tongue becomes paralyzed, but retains sensation.

Dissect the stylopharyngeus muscle: the nerve which is found at its lower margin is called the glossopharyngeal.

The *glossopharyngeal nerve* is a division of the eighth nerve: in its separate passage through the foramen lacerum inferius an oblong ganglion is formed upon it: it passes forward between the internal and external carotid arteries emerging from within the lower margin of the stylopharyngeus which it supplies, together with the upper constrictor of the pharynx; it gives likewise a branch to the par vagum: the glossopharyngeal nerve finally terminates in a *lingual branch* distributed to the surface of the tongue near its base, and especially to the papillæ conicæ; and in a *pharyngeal branch*, which supplies the middle and inferior constrictors of the pharynx.

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§ VII. OF THE ORGANS OF SMELL AND TASTE.

The present opportunity may be employed in the examination of these parts.

Dissect the muscular substance and the nerves from the cartilages, which are attached to the nasal bones.

The *cartilago alæ nasi* immediately encloses the aperture of the nostril; its external fold convex outwards and nearly half an inch in depth tapers backwards, and beyond its termination three or four detached portions of cartilage connected together by

membrane are incurvated inward and forward: the inner fold of the cartilago ala nasi is not so deep as the outer portion, and is applied to and adheres to the side and lower edge of the cartilago septi narium.

The *cartilago nasi lateralis* is triangular, cohering behind with the margin of the nasal and superior maxillary bones, before with the cartilago septi narium, and having as a base an inferior horizontal margin partly unattached, but overlapped by the outer portion of the cartilago alæ nasi.

The *cartilago septi narium* is exposed on removing the preceding on either side: this cartilage is nearly triangular, and larger than the preceding: its upper and posterior margin coheres with the suture of the nasal bones, and with the under edge of the nasal process of the ethmoïd; its under and posterior margin coheres with the anterior edge of the *vomer*, and with the suture of the superior maxillary bones: anteriorly its outline determines the prominence of the nose, and has a projecting edge on either side, to which the cartilago nasi lateralis is affixed.

The sentient organ consists of a thick and highly vascular mucous surface, called the *Schneiderian membrane*, which is spread over the walls of the nostrils, and is continuous behind with the membrane of the pharynx.

You notice the projections of the two ossa turbinata partitioning outwardly into three channels the cavity of the nostril, which internally is bounded by the plane surface of the septum: the *superior meatus* of the nostril is the tract between the septum and superior turbinated bone: the *middle meatus* is that between the two turbinated bones: the *inferior meatus* is the pas-

sage between the lower turbinated bone and the superior maxillary.

It may be remarked, that the sphenoïd cells communicate with the posterior cells of the ethmoïd bone, which open upon the superior cornu of the ethmoïd, and thus into the superior meatus of the nostril: that the frontal sinuses communicate with the anterior cells of the ethmoïd, which open upon the inferior cornu of the same bone, and thus terminate in the middle meatus: and that the antrum of Highmore in addition opens into the same tract; but there is more practical use in examining the passage of the lacrymal duct, which opens into the inferior meatus: the lacrymal duct runs vertically downwards from the lacrymal sac (which is lodged in the fossa formed by the os unguis and nasal process of the superior maxillary bone), in a canal almost completed in the superior maxillary bone, but closed by the apposition of the os turbinatum inferius. A probe may readily be passed from the nostril along the duct into the sac: for this purpose at nine or ten lines from its extremity the instrument should be bent nearly to a right angle, and introduced into the nostril with the point downwards and outwards, which is to be elevated outwards, when below the sac, into the angle between the turbinated bone and the superior maxillary, where, if no force be used, it cannot fail of finding the aperture of the duct. The nostrils may be further examined with reference to the extraction or tying of polypi, which grow from the mucous surface, or to the passage of instruments into the pharynx.

Flexible instruments are readily passed from the nostril or the fauces into the pharynx: if carried directly backwards and pressed against the posterior

surface of the pharynx, a flexible instrument glides downwards with certainty into the œsophagus. An instrument to pass from the fauces into the larynx should be inflexible, and curved so that the last three inches should be at a right angle with the handle of the instrument, and the point yet further incurvated.

The branches of the first and second divisions of the fifth, which are distributed upon the Schneiderian membrane, have been already described: in addition, the first nerve may be traced perforating the cribriform lamella and spread in a copious plexus over the septum and ossa turbinata. The interesting experiments of M. Majendie have made it doubtful in what degree these different nerves contribute to the sensibility of the nostrils.

The *organ of taste* is yet simpler than that of smell. It consists in a mucous membrane spread upon the muscular flesh of the tongue, which was described in a former dissection. This mucous membrane presents considerable variety in the form of the little projections which rise from it.

Centrally, about an inch from the epiglottis, a small pit, the *foramen cæcum*, may be found; behind the level of which the surface of the tongue is irregularly elevated by the margins of mucous follicles.

From the foramen cæcum on either side seven great papillæ are disposed in a line directed obliquely forward and outward towards the margin of the tongue: they are termed *papillæ conicæ*. They are attached by their apices, and rise to a broad, flat, or slightly excavated base, which is level with the surface of the tongue; so that each is contained in a conical cup, the

margin of which is in contact with, but does not adhere to the papilla.

The *papillæ conoïdeæ* are the numerous papillæ which cover all the anterior surface of the tongue; they seem disposed in ranks parallel to the papillæ conicæ.

The *papillæ filiformes* are the finest shreds of the membranous surface, and are met with principally at the edges of the tongue.

The *papillæ fungiformes*, are those, which appear to be connected with the perception of the savour of bodies: they are disposed in greatest numbers at the edges and apex of the tongue, where they scarcely exceed in size the papillæ conoïdeæ: they are fewer, but larger upon its dorsum: they are erectile; the contact of a sapid body renders them distinctly prominent upon the surface of the tongue.

On dividing the gustatory nerve in a dog, I found that the surface had no sensation of taste or feeling; but the muscles of the tongue were not paralyzed.

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§ VIII. DISSECTION OF THE ORGAN OF HEARING.

The two portions of the seventh nerve enter the meatus auditorius internus together: the *portio dura* is placed above and rather before the *portio mollis*.

If the section of the head have been macerated in dilute muriatic acid, the distribution of these nerves through the temporal bone is readily traced. The hardness of the petrous portion is such, that in the adult and unprepared bone the greatest care is required in

cutting away the surfaces of the different canals and cavities without injuring their contents. Perhaps in such a rude course of dissections as I am now describing, a considerably coarser method will suffice to shew the student the leading points in the anatomy of the internal ear.

Place the edge of a broad and sharp chissel horizontally against the inner surface of the pars petrosa at the level of the superior margin of the meatus auditorius internus, and strike the instrument a sharp blow. The shell of bone detached by this process will enable you to remark the following circumstances.

1. That the meatus auditorius internus extends horizontally outward and very slightly backward to the depth of about three to four lines, where it seems to terminate abruptly, though, in fact, its extremity is pervious to the branches of the portio mollis.

2. That a little before the termination of the meatus auditorius internus a separate canal is inclosed above, termed the *aqueduct of Fallopius*, and running parallel to the meatus. In this canal is lodged the portio dura, which does not change its course till the vidian canal enters the aqueduct of Fallopius conveying the vidian nerve to join the portio dura, which is swollen at this juncture, and abruptly inclined backward so as to run in a course at right angles with its former direction. The portio dura finally at half an inch from this angle is inclined downwards, and runs directly to the stylo-mastoïd foramen, where it emerges.

3. That the pars petrosa is hollowed into numerous chambers, which are called the *labyrinth of the ear*.

4. That a narrow but deep and long cavity is interposed between the outer wall of the labyrinth, and that

plate of bone, the under surface of which forms the glenoïd fossa. This cavity is called the *tympanum*, communicating behind with the *cells* of the *mastoïd* process, before with the posterior fauces by the *Eustachian tube*, closed externally by the *membrana tympani*, or, if that be wanting, open to the meatus auditorius externus.

1. *Of the Labyrinth.*

The central cavity of the labyrinth is called the *vestibule:* in form elliptical, in depth about three lines, divided by an acute spine, terminating in what is called the pyramid, into two fossæ, an upper and outer semielliptic, a lower and inner hemispherical. The vestibule is placed external to and rather behind the termination of the meatus auditorius internus: it has five openings upon its upper, under, and posterior surface leading into three semicircular canals, each a line in diameter, which form the posterior chambers of the internal ear.

The *superior vertical semicircular canal* opens from the upper and outer part of the vestibule by an ampullated commencement; then becoming cylindrical it is incurvated transversely; its inferior horn opens by a common tube and orifice with one extremity of the *inferior vertical canal*, which is incurvated from this point longitudinally or parallel to the long axis of the pars petrosa; its remaining horn opens upon the floor of the vestibule, being ampullated at this part.

The *oblique semicircular canal* begins with an ampulla immediately within and below the upper opening of the superior vertical canal; its course is obliquely

inwards and backwards; it opens at the posterior surface of the vestibule.

The *aquæductus vestibuli* opens by a sixth orifice into the vestibule below the common aperture of the superior and inferior vertical canals, and leads to an oblique orifice upon the inner surface of the pars petrosa behind and below the meatus auditorius internus.

The *fenestra ovalis* is the large oval foramen, closed by a membrane at the upper and outer part of the vestibule, which looks into the tympanum.

The anterior chambers of the internal ear are two conical tubes twisted spirally two turns and an half round a central *modiolus*. The whole apparatus is termed the *cochlea;* it is situated immediately before, and at a lower level than the first part of the Fallopian tube.

The *modiolus* of the cochlea is horizontal, and directed outward and slightly forwards: a layer of cartilage, termed the *lamina spiralis*, is attached to a spiral ridge upon the modiolus, so as to divide a single conical canal of bone into two; the two canals are termed the *scalæ cochleæ;* they communicate at the apex of the cochlea; the large extremity of the upper canal opens below into the vestibule, whence the upper scala is called the *scala vestibuli;* it is more capacious than the lower, which opens at the fenestra rotunda upon the tympanum, whence it is termed the *scala tympani*. The fenestra rotunda is closed by a membrane.

The *aquæductus cochleæ* is a conical and curved tube which extends from the scala vestibuli to an opening between the canalis caroticus and jugular fossa.

The chambers of the labyrinth are lined with an

elastic membrane, which contains a serous fluid: the two smaller branches of the portio mollis are distributed upon this membrane in the vestibule and semicircular canals; its larger portion perforates the base of the modiolus, and emerging from its porous sides, spreads out its branches upon the lamina spiralis.

2. *Of the Tympanum.*

The conical cartilaginous part of the *Eustachian tube* opens obliquely upon the posterior fauces immediately behind the soft palate at the level of the floor of the nostrils, and leads backwards, outwards, and upwards into the cavity of the tympanum. The fenestræ rotunda and ovalis being closed by their respective membranes, the tympanum has no communication internally with the labyrinth: externally again the membrana tympani closes the outlet towards the meatus auditorius externus. The cavity of the tympanum is lined with a vascular mucous surface and filled with air, both of which are derived along the Eustachian tube from the posterior fauces and pass onwards into the cells of the mastoïd process.

The *membrana tympani* has a cuticular covering on either side: it is highly vascular, and contains fibres converging towards its centre, which is drawn inwards by a chain of bones, that connect it with the membrana fenestræ ovalis.

The *stapes* is the bone connected with the membrana fenestræ ovalis: it is of the shape of a stirrup-iron, of which the base exactly corresponds to the margin of the fenestra ovalis, and if viewed from below represents very perfectly the form of the sole of the foot of the

opposite side; the anterior crus is short, straight, and slight; the posterior curved, thick, and strong; the crura unite in the capitellum, which is directed outwards.

The *os orbiculare* is a small spherical bone interposed between the head of the stapes and

The *incus*, or anvil bone, that has one long crus directed vertically downwards, and incurvated inwards at its extremity, which joins the os orbiculare: a short crus directed obliquely downwards and backwards, the extremity of which is articulated to the floor of the entrance into the mastoïd cells: the body of the incus has a concave face looking forward to be articulated to

The *malleus*, the long axis of which again is vertical and parallel to the long crus of the incus; the head of the malleus is oval and articulated with the incus; the neck tapers and is inclined slightly outwards as well as downwards, from which the long process of the malleus projects forwards towards the glenoïd fissure, the short process outwards: beyond the neck the manubrium or tapering handle of the malleus is at first inclined inwards, and finally at its extremity incurvated outwards to be affixed to the centre of the membrana tympani.

Four small muscles acting upon these bones give different degrees of tension to the membranes with which they are connected.

1. The TENSOR TYMPANI is the largest of these; it *arises* and is lodged in a groove above and parallel to the Eustachian tube, whence it emerges upon the inner and upper surface of the tympanum, which the tendon crosses to be *inserted* into the neck of the malleus.

2. The LAXATOR TYMPANI is a slender shred of muscle, which *arises* and descends from the roof of the tympanum to be *inserted* into the outside of the neck of the malleus.

3. The EXTERNUS MALLEI is lodged in and *arises* from the margins of the glenoïd fissure; its tendon is *inserted* into the long process of the malleus.

The inner wall of the cavity of the tympanum is raised into a tubercle termed the *promontory* (exactly opposite to the axis of the meatus auditorius internus), above which is the fenestra ovalis, below the fenestra rotunda: on a level with the promontory and behind it is a small conical eminence termed the pyramid, it is perforated by the tendon of,

4. The STAPEDIUS, which *rises* within a cavity in the pyramid, and is *inserted* into the capitellum of the stapes: it is calculated to give tension to the membrana fenestræ ovalis.

The *chorda tympani nerve*, derived from the portio dura in the aqueduct of Fallopius after it has been joined by the Vidian nerve, enters the cavity of the tympanum by a small foramen external to the pyramid, passes forward between the long crus of the incus and the manubrium of the malleus, supplying sentient and voluntary nerves to the parts within the tympanum, and finally, is transmitted through the glenoïd fissure to join the gustatory nerve.

The cartilage, which forms the external ear, completes with the bony meatus a tube more than an inch in depth, and incurvated like an italic *ſ*: it has been already described.

§ IX. DISSECTION OF THE NERVES OF THE NECK.

The nerves of the neck are, on the one hand, of cerebral origin; on the other, derived from the spine. Of the first kind are the nervus vagus and the sympathetic, which descend vertically from the base of the skull to the chest; of the second are the spinal accessory nerve, the suboccipital nerve, the seven cervical nerves, and the first dorsal: the present section treats of the latter division.

The *spinal accessory nerve* is a part of the eighth pair: it is readily found on everting the anterior edge of the sterno-cleido-mastoïdeus, the inner surface of which its principal division perforates about opposite to the angle of the lower jaw: from this point the nerve may be traced in either direction, to verify the following description. The spinal accessory nerve leaves the cranium in contact with the nervus vagus, through the foramen lacerum inferius, and immediately divides into two branches. The *internal branch* is distributed in filaments, some of which coalesce with the nervus vagus, and increase its bulk, and sometimes with the ninth nerve; others of which are joined by filaments from the nervus vagus, and thus reinforced form a nerve which supplies the upper part of the pharynx.

The *external branch* perforates the substance of the sterno-cleido-mastoïdeus, which it supplies with filaments, is joined within it by branches from the first and second cervical nerves, emerges near the posterior margin of the muscle, and gains the inner surface of the trapezius, upon which it descends, and is finally distributed.

Detach the sterno-cleido-mastoïdeus from its inferior attachment: branches of the nine spinal nerves above enumerated are readily found emerging at the outer margin of the rectus capitis anticus major, or between the scalenus anticus and the scalenus medius.

Every spinal nerve divides into an anterior branch; that, for instance, which in the neck is exposed by the method directed; and a posterior branch, which is distributed principally to the muscles and integuments behind the vertebral column.

Of the two branches into which each spinal nerve divides, the posterior is the largest in the instances of the suboccipital and the first cervical nerve; in every other instance the anterior branch is the largest, and alone deserves a special description.

The anterior portions of the nine upper spinal nerves, which are those implicated in the present dissection, coalesce with each other by reciprocal branches, and send filaments to join the sympathetic.

I. The *suboccipital nerve* specially supplies the recti and obliqui, and other muscles attached to the base of the skull.

II. The *first cervical nerve* gives from its anterior division a branch already spoken of to join the descendens noni, from its large posterior division a branch to join the spinal accessory nerve, and branches to supply the neighbouring muscles: the trunk of the posterior branch finally perforates the complexus, and is distributed upon the muscles and integuments of the back part of the head, under the name of *nervus occipitalis major*.

III. The *second cervical nerve* gives off a branch to join the descendens noni, a filament to the phrenic

nerve; and a branch which, joined by filaments from the first cervical, emerges upon the occiput under the name of *nervus occipitalis minor*, then joins and is distributed with the occipitalis major.

While covered by the sterno-cleido-mastoïdeus the second cervical nerve gives off a branch to join the spinal accessory: after turning over the outer edge of that muscle it passes forward upon the neck in two final branches, covered by the platysma myoïdes; of which the uppermost, or *nervus auricularis*, ascends towards the ear, and is distributed by a larger filament to the ear and occiput, by a smaller anterior filament upon the cheek as far as to the malar bone, in which course it coalesces with branches of the portio dura. The lower branch, or *nervus superficialis colli*, crosses the neck transversely, and is distributed to the platysma myoïdes and integuments.

IV. The *third cervical nerve* furnishes the principal root of the *phrenic*, as that nerve is termed, which descends upon the forepart of the scalenus anticus towards the chest; and two or three large cutaneous branches, which are found below the skin, to the outside of the sterno-cleido-mastoïdeus, and are distributed to the lower part of the neck, to the integuments of the neck and shoulder; and, finally, branches which pass backward to the muscles above the shoulder.

V. VI. VII. VIII. IX. The large anterior divisions of the *four lowest cervical nerves*, and of the *uppermost dorsal nerve*, supply the shoulder, arm, fore-arm, and hand. They emerge between the scalenus anticus and medius, are inclined outwards, and each more obliquely downwards as it rises higher in the neck: they coalesce either directly or indirectly by reciprocal branches to

form what is termed the axillary plexus. Generally the fourth and fifth cervical nerves unite to form one trunk; and the seventh cervical and uppermost dorsal to form another; while the sixth cervical passes outwards for some time between them, and without joining either.

The fourth cervical furnishes a considerable filament to the root of the phrenic; the fifth supplies a smaller filament.

It is immaterial at present whether the student pursue the distribution of the nerves derived from the axillary plexus, or dissect the branches of the nervus vagus, sympathetic, and phrenic.

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§ X. DISSECTION OF THE NERVES OF THE THROAT, THORAX, AND ABDOMEN.

REMOVE the sternum, press aside the clavicles, and saw off the fore part of the ribs on the left side, leaving only the marginal cartilages of the chest to preserve the diaphragm entire: it will be easy to identify and follow the general distribution of each nerve by means of the following description.

1. *Of the Phrenic Nerve.*

The *Phrenic nerve* is formed by filaments derived from the anterior portions of the third, fourth, and fifth cervical nerves, from the nervus vagus, from the ninth nerve, and not unfrequently from the second cervical nerve, and from the sympathetic. It descends upon the fore part of the scalenus anticus, the fibres of

which it crosses obliquely, being confined to their surface by a thin fascia: at the root of the neck it is interposed between the scalenus anticus and the subclavian vein; immediately behind which it enters the chest, and, attaching itself to the pericardium, passes onward to the diaphragm.

The *right* phrenic nerve descends in a directer course, and at a level anterior to the descent of the *left phrenic nerve*, between the pericardium and the pleura reflexa.

The *right* phrenic nerve sometimes sends a twig to the pulmonic plexus: it divides into filaments before it reaches the convex surface of the diaphragm. These filaments radiate upon the diaphragm, which the larger perforate near the passage of the vena cava, and, after supplying the adjoining muscular substance, distribute twigs, which frequently enlarging into ganglia, descend along the course of the phrenic arteries, and are distributed upon the lesser muscle of the diaphragm, the liver and renal capsules, and the semilunar ganglion.

The *left* phrenic nerve differs little in distribution from the right: sometimes a branch derived from it passes through the diaphragm along with the œsophagus, coalescing with the nervus vagus. Generally, the left phrenic nerve connects itself less extensively with the visceral nerves than the right.

2. *Of the Nervus Vagus.*

The *nervus vagus* descends nearly vertically in the neck, attached to the outside of the internal, and afterwards of the common carotid artery, having emerged from the cranium at the foramen lacerum inferius, and immediately afterwards having given branches of union

to the ninth nerve and spinal accessory, with both of which it is for a short space in contact, and sometimes, but rarely, to the sympathetic; having lastly swollen into an oblong ganglion upon receiving branches from the spinal accessory.

The nervus vagus, opposite to the upper part of the pharynx, gives off, I, the *nervus pharyngeus superior;* and II, the *nervus pharyngeus inferior*, which, passing behind the internal carotid artery, coalesce, and are distributed to the constrictors of the pharynx;

III. The *nervus laryngeus internus*, which passing behind the internal carotid artery, descends obliquely forwards to the interval between the middle and inferior constrictors of the pharynx, and is distributed in part upon the mucous membrane of the larynx, in part to the arytenoïdei obliqui and arytenoïdeus transversus, and to the crico-thyreoïdeus. Thus the *nervus laryngeus internus* supplies muscles, which tend to close the aperture of the larynx;

IV. The *nervus laryngeus externus*, which is partly derived from the sympathetic, and is distributed to muscles near and external to the larynx and pharynx, and to the thyreoïd gland.

V. The nervus vagus, between the middle and lower part of the neck, gives off *two*, *three*, or *four* slender *cardiac branches*, which descend inclined inwards towards the aorta.

VI. The nervus vagus enters the chest anterior to the subclavian artery, and upon the right side reflects a branch behind this vessel at its origin from the arteria innominata to re-ascend in the neck, termed *laryngeus inferior*, or *nervus recurrens*. Upon the left side, the recurrent nerve is similarly reflected round the under

surface of the aorta at the point where the ductus arteriosus joins its arch.

The recurrent nerve ascends in the furrow, at which the surfaces of the trachea and œsophagus recede from each other, distributes branches to either of those tubes, branches to join the cardiac plexus, and finally enters the larynx between the thyreoïd and cricoïd cartilages to be distributed to the membrane of the larynx, and to the thyreo-arytenoïdei, crico-arytænoïdei postici and laterales. The division of this nerve on either side in animals prevents the production of vocal sounds, and, together with the division of the superior laryngeal, was found by M. Majendie to interfere materially with the process of deglutition, though the epiglottis remained entire.

VII. The nervus vagus continues to descend behind the root of the lungs, to which it gives off numerous filaments, distributed as the lesser *anterior* and larger *posterior pulmonic* plexus.

VIII. The trunk of the nerve then attaches itself to the œsophagus, and is distributed with its fellow as a great plexus upon this portion of the alimentary tube; each nerve at the same time descends in two principal chords, or series of filaments reciprocally coalescing, one nearer the anterior, the other nearer the posterior surface of the œsophagus; hence the terms *anterior* and *posterior œsophageal plexus*. Here and there a small ganglion occurs upon the filaments of the par vagum: the left nerve is observed to be distributed more extensively over the anterior surface of the œsophagus, the right over its back part.

The greater part of the left half of the diaphragm may now be removed, in order to expose the distribu-

tion of the par vagum in the abdomen. The par vagum terminates in branches distributed to the stomach, liver, pancreas, and spleen, and to the semilunar ganglia. The branches, which pass to the lesser curvature of the stomach and to the left lobe of the liver, are principally derived from the anterior œsophageal plexus; the posterior œsophageal plexus more especially supplies the great curvature of the stomach, and sends branches with the hepatic artery to the duodenum and right lobe of the liver. The visceral branches of the par vagum freely coalesce with the branches derived from other sources to the same parts, their distribution being invariably plexiform.

Upon dividing the par vagum, if an animal does not quickly perish from the paralysis of the larynx, which follows, digestion is found to be prevented, and death ensues from an inflammation of the stomach in three or four days' time.

3. *Of the Sympathetic Nerve.*

The *sympathetic nerve*, which commences, by the union of branches of the sixth nerve with branches of the Vidian nerve in the carotid canal, and descends as a plexus around the internal carotid artery, emerges at the foramen caroticum, and is found as a single, double, or triple trunk, descending in the neck upon the rectus capitis anticus major, and afterwards upon the longus colli: it then descends into the thorax, is found upon the necks of the ribs covered by the pleura; at the lower part of the thorax it is inclined inwards; in the loins, it is found attached to the sides of the lumbar vertebræ, and in the pelvis to the fore part of the

sacrum, not far from its edge; finally, the sympathetic nerve unites with its fellow upon the os coccygis, each being one continuous chord from the os coccygis to the cavernous sinus.

The sympathetic nerve is studded with ganglia; an *upper* and a *lower cervical ganglion* is formed upon this nerve in the neck, and frequently a *middle cervical ganglion:* the uppermost is oblong, generally an inch in length, the lowermost triangular, or more or less spherical. Opposite to each of the vertebral bones of the chest, loins, and sacrum, one ganglion is invariably found upon either nerve: these ganglia are named numerically in the region they occupy.

At the union of the two nerves upon the os coccygis, the ganglion impar is found.

The colour of the sympathetic nerve is grey; in parts the nerve is semitransparent.

The sympathetic nerve, as it parts with numerous branches, so is it continually reinforced by branches derived from the spinal nerves.

The suboccipital nerve, and the first and second and third cervical nerves, send filaments to the *superior cervical ganglion.* The remaining cervical nerves contribute to the *inferior:* or the middle cervical nerves send branches to the trunk of the sympathetic, or to a *middle* cervical ganglion.

In the thorax, loins, and pelvis, each ganglion receives two filaments from the corresponding spinal nerve.

The *sympathetic nerve in the neck* gives off, 1st, from two to six *nervi molles,* which are distributed to the carotid artery and its branches, and are joined by filaments of the fifth and seventh nerves, of the glosso-pharyn-

geal, and of the nervus vagus; 2dly, and in general above the middle of the neck the *nervus superficialis cordis*, which inclines inwards towards the trachea, is joined by part of the cardiac branches of the nervus vagus, and filaments from the recurrent nerve; the whole being distributed at length as an extensive plexus around the subclavian artery, the arteria innominata, the aorta and base of the heart. In this plexus small gangliform swellings occur irregularly: a ganglion is often found behind the arch of the aorta; the nervous filaments distributed upon the base of the heart form the *anterior* and *posterior cardiac plexuses*, the branches of which accompany the coronary arteries.

The *sympathetic nerve in the thorax*, gives off filaments in succession from its sixth, seventh, eighth, ninth, and tenth ganglia (one from each), which pass forward, downward, and inward, to coalesce in one trunk called the *nervus splanchnicus;* or sometimes in two, in which case the inferior is smaller, and called the *splanchnicus minor*.

The *splanchnic nerve*, which may be enumerated as one of the contents of the lower part of the posterior mediastinal cavity, *passes into the abdomen* upon the lumbar vertebræ, between the outer attachments of the lesser muscle of the diaphragm, and is immediately received into a curved nodular ganglion, which extends transversely before the lesser muscle of the diaphragm and is called the *semilunar ganglion*. To this ganglion branches are derived from the nervus vagus and the phrenic; and from it branches are derived which unite it with its fellow, and form an intricate plexus upon the aorta, called the *solar plexus*, the branches of which are distributed with those of the aorta, and assume the

name of the artery, the course of which each follows, as that of *cœliac*, *superior* and *inferior mesenteric*, *renal*, *spermatic*, and the like; numerous little ganglia are found irregularly dispersed upon the filaments of the visceral plexuses.

A nerve analogous to the splanchnic, is derived from the three uppermost lumbar ganglia of the sympathetic, which descends obliquely upon the lumbar vertebræ to join its fellow, upon the lowest. These nerves are the principal origin of the *hypogastric* plexus, which is distributed to the side of the uterus and bladder along the branches of the internal iliac artery, and is reinforced by numerous branches from the third sacral nerve: several ganglia are found in this plexus.

Thus the sympathetic nerve principally supplies the heart, the abdominal viscera (with the exclusion of the stomach) the pelvic viscera, and the coats of the blood-vessels, as the par vagum principally supplies the respiratory and vocal organs, the œsophagus and the stomach.

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§ XI. DISSECTION OF THE NERVES DERIVED FROM THE AXILLARY PLEXUS.

The axillary plexus extends from the margin of the scaleni to the middle of the axilla; for this extent, a continued interlacement occurs between the five nerves of the plexus, by oblique chords reciprocally given off and received, or by the direct coalition of adjoining nervous trunks. The course of the axillary nerves is obliquely downwards and outwards; in the

upper part of the axilla, the five nerves, having converged, from a tube through which the axillary artery passes. Branches are derived from the axillary plexus to the chest, to the shoulder, to the arm and hand. The clavicle should be detached either at its sternal or scapular extremity, to allow of the complete exposure of the first branches given off.

1. *Of the Nerves distributed to the Chest.*

I. The *anterior thoracic nerves* are three or four filaments derived from the fore part of the axillary plexus, which descend behind the clavicle to supply the pectoralis major, the pectoralis minor, and the subclavius.

II. The *posterior thoracic nerve* descends from the upper and back part of the axillary plexus upon the serratus magnus at right angles to the fibres of that muscle, which it supplies.

2. *Of the Nerves distributed to the Shoulder.*

III. The *suprascapular nerve* is derived from the upper part of the axillary plexus, to the notch of the scapula, through which it passes to supply the supraspinatus, infraspinatus, and teres minor.

IV. The *subscapular nerves* are generally three branches, derived from the lower edge of the axillary plexus below the clavicle, which descend upon the surface of the subscapularis, to supply that muscle, the teres major, and the latissimus dorsi.

V. The *circumflex nerve* is a single large trunk,

which dips into the interval between the subscapularis, teres major, and long head of the triceps extensor cubiti, and turning round the shaft of the humerus, is distributed to the deltoïd muscle.

From all of these nerves cutaneous twigs are derived.

3. *Of the Nerves distributed to the Arm.*

With this class are to be connected slender branches derived from the third, fourth, and frequently the fifth dorsal nerves, termed *intercosto-humeral nerves*, which traverse the axilla, and distribute filaments to the absorbent glands and integuments, of which one is commonly prolonged for some distance upon the integuments covering the inner and posterior surface of the triceps extensor cubiti.

6. The *internal cutaneous nerve of Wrisberg*, descends from the inner and lower part of the axillary plexus by a common trunk with the ulnar, or as a branch of the ulnar is distributed to the integuments and the back and inner surface of the triceps extensor cubiti, and elbow-joint, by a *ramus posterior minor*, and a *ramus prior major*, a filament of which coalesces with the middle cutaneous nerve.

7. The *middle*, or *internal cutaneous nerve* is of the size of a crow-quill, and derived principally from the first dorsal nerve: it is formed in part from the lowest cervical as a distinct nerve before and within the axillary artery, which it accompanies half way to the elbow-joint, and then gradually recedes inwards towards the inner condyle of the humerus. In its passage to the bend of the elbow it gives a filament to the coraco-

brachialis, to the triceps flexor cubiti, and filaments to the integuments.

The middle cutaneous nerve divides above the elbow-joint into a smaller branch, the *ramus cutaneus ulnaris*, and a larger, the *ramus cutaneus palmaris*, which descend upon the integuments of the fore and inner part of the fore-arm before or behind the cutaneous veins, which they cross, subdividing into numerous filaments, some of which coalesce with filaments of the external cutaneous nerve, and extend to the wrist.

8. The *external cutaneous nerve*, or *perforans Casserii*, is formed from the fourth, fifth, and sixth cervical nerves, is larger than the preceding, becomes a separate trunk on the outside of the axillary artery opposite the shoulder-joint; is inclined outwards, and perforates in most instances the coracobrachialis, which it supplies; descends obliquely between the biceps flexor cubiti and brachialis internus, giving branches to both; emerges from behind the former above the elbow-joint, becomes subcutaneous, and is distributed in *two long branches*, which are implicated with the cephalic and median cephalic veins, upon the fore and outer part of the fore arm of the wrist and hand. The distribution of these branches is cutaneous, with the exception of a filament to the supinator radii longus, and another to the flexor carpi radialis.

9. The *median nerve* is of great size, and derived from the five nerves of the axillary plexus; is formed upon the axillary artery between the middle and external cutaneous nerves, by the junction of two large fasciculi; it descends before the brachial artery, or between the two in cases of an high division, to near

the bend of the elbow, when it recedes towards the inner condyle, and gives a filament to the brachialis internus. The median nerve then perforates the pronator radii teres, supplying that muscle, and giving branches at the same time to all those placed upon the fore and inner part of the fore arm, of which the most remarkable is that derived to the pronator radii quadratus, which descends before and in contact with the arteria interossea communis. The median nerve descends in the middle of the arm towards the wrist between the flexor digitorum sublimis and the flexor profundus. Just above the wrist, it is left in contact with the fascia between the tendons of the flexor carpi radialis, and of the flexor digitorum sublimis; it enters the hand behind the ligamentum carpi transversale, and divides into two great branches, from which filaments are commonly derived to the muscles occupying the outer two-thirds of the hand, besides two towards the edges of the thumb, one towards the radial edge of the fore finger, and one to each of the intervals (where it subdivides) between the fore and middle, and the middle and ring finger. From the latter series either edge of the thumb, of the fore and middle fingers, and the radial edge of the ring finger, are supplied each by a long digital nerve, which terminates only at the extremity of the finger. It may be remarked, that the branches of the median nerve in the hand lie behind the palmar arch of the ulnar artery; but at the sides of the fingers are placed before the long digital arteries, which that vessel or the radial gives off.

10. The *ulnar nerve* is less than the median, and is commonly derived from the lowest cervical and uppermost dorsal nerve: it is formed on the inside of the

axillary artery in common with the internal and middle cutaneous nerves: it quickly recedes from the brachial artery, and descends upon the brachialis externus to the back part of the inner condyle, above which it sends off a cutaneous branch. The ulnar nerve then passes between the inner condyle and the origin of the flexor carpi ulnaris, to which muscle, and to the flexor digitorum profundus, it gives filaments; descends to the wrist before and in contact with the flexor profundus digitorum, being on the ulnar side of and adherent to the ulnar artery; above the wrist it divides into the *ramus dorsalis*, which passes between the tendon of the flexor carpi ulnaris and the ulna to supply the inner third of the back of the wrist and hand; and a much larger branch, or *ramus volaris*, which accompanies the ulnar artery before the ligamentum carpi transversale, to the hand, supplies the muscles of the little finger, and sometimes all the interossei and lumbricales, and the adductor pollicis; as well as sends a digital branch to the inside of the little finger, and one which, at the separation of the little and ring finger, subdivides to supply their opposite margins, and to complete the series of digital nerves.

11. The *spiral nerve* is the largest branch of the axillary plexus: it takes an origin from each of the elementary nerves of the plexus, but principally from the three upper; it lies at first behind the axillary artery, then passes obliquely backwards and downwards towards the interval between the inner and middle portions of the triceps extensor cubiti: gives off a cutaneous filament, enters the intermuscular interval alluded to with the arteria profunda humeri superior; supplies the triceps, turns spirally round the back of

the humerus, emerges from the triceps at the outside of the arm into the deep fossa, which exists between the brachialis internus and supinator radii longus, and gives off a cutaneous branch to the outside of the elbow and fore arm.

The spiral nerve, thus deeply situated, divides into a larger branch its *ramus profundus*, which perforates the supinator radii brevis, and supplies this muscle and every other of the class occupying the outer and back part of the fore arm; and a smaller branch, the *ramus superficialis*, or *radialis*, which descends along the interval between the supinator radii longus and the flexor muscles of the carpus, gives branches to the extensores carpi radialis, and is situated upon the outside of the radial artery till within four inches of the wrist, when it passes between the tendons of the supinator radii longus and flexor carpi radialis longior obliquely round the radius to the back of the wrist, giving twigs to the extensores internodiorum pollicis and to the opponens pollicis, and two or three larger filaments to the integuments covering the outer two-thirds of the back of the hand.

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§ XII. DISSECTION OF THE DORSAL NERVES.

The *eleven lower dorsal nerves* are attached to the lower margins each of the corresponding rib: at first they are placed between the pleura costalis and the intercostal muscles; beyond the angles of the ribs they are placed between the two intercostal muscles:

their position is below the intercostal arteries; they are consumed in filaments, which supply the muscles and integuments near their course, and each, as has been mentioned, gives off two twigs to the adjoining ganglion of the sympathetic. As regards the individual dorsal nerves, it may be sufficient to remark, that the second dorsal furnishes branches to the gland of the mamma, and that the eleventh and twelfth give twigs to the diaphragm.

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§ XIII. DISSECTION OF THE LUMBAR NERVES.

The anterior branches of the lumbar nerves form an intricate plexus covered by the origins of the psoas magnus. On dissecting off the peritoneum and fascia iliaca from the fossa of the ilium, 1, two small nerves are seen, which are derived from the first and second lumbar to the fore part of the crest of the ilium, and one or more filaments, which emerge through the fore part of the psoas magnus, and are directed towards the groin; 2, a great trunk called the *anterior crural nerve*, derived from branches of the four superior lumbar nerves, which emerges from between the psoas magnus and iliacus internus, at the outer edge of the latter near the ligament of Poupart: and 3, a smaller trunk, called the *obturator nerve* derived from branches of the second, third, and fourth lumbar nerves, and emerging from behind the inner margin of the psoas magnus, and thence directed towards the aperture at the outer part of the membrana obturans.

From these three sources may be traced, 1, cutaneous inguinal nerves, 2, cutaneous crural nerves, 3, muscular nerves, 4, cutaneous tibial nerves.

1. *Of the cutaneous inguinal Nerves.*

The outermost nerve derived from the first lumbar to the crest of the ilium is called the *external spermatic*, or *circumflex inguinal nerve;* it perforates, above the crest of the ilium, the transversus abdominis, descends inwards between the transversus and obliquus internus, reaches the spermatic passage, is situated above the chord, and with it emerges at the external ring, to be distributed upon the integuments of the groin.

The nerve or nerves which emerge from the fore part of the psoas magnus may be called *anterior inguinal nerves;* they are distributed to the fat and glands and integuments of the groin.

2. *Of the cutaneous crural nerves.*

The nerve similar, and in its course nearly parallel to the external spermatic, is the *external cutaneous crural nerve;* it is distributed in two principal branches upon the outer part of the thigh.

The *middle and internal cutaneous nerves* are branches from the anterior crural nerve in the thigh, given off immediately below Poupart's ligament, and perforating the fascia lata not long after; the middle cutaneous nerve emerges the first; their branches extend to the knee.

3. *Of the muscular branches derived from the lumbar nerves.*

The *anterior crural nerve*, while in the pelvis, gives branches to the psoas magnus and iliacus internus; it emerges from the pelvis behind Poupart's ligament, crossing obliquely before the tendon of the iliacus internus, when it is almost wholly consumed in branches which supply the tensor vaginæ femoris, the quadriceps extensor cruris, the sartorius, the pectineus, the gracilis, and semitendinosus. Branches of the nerves, which have supplied the sartorius, emerging from it, become cutaneous.

The *obturator nerve* gives twigs to the psoas magnus in its passage by it, leaves the pelvis through the aperture of the membrana obturans, divides into a *ramus prior*, which descends behind the adductor longus, supplying that muscle, the adductor brevis and the gracilis, and terminating in a branch, which coalesces with the nervus saphænus: and 2, a *ramus posterior*, which is situated nearer the os femoris than the former, and distributes filaments to the obturator externus, to the adductor longus and brevis, but principally is employed in supplying the adductor magnus.

4. *Of the cutaneous tibial nerves.*

The final branches of the anterior crural nerve are two, which descend with the femoral artery upon the fore part of the thigh: after that vessel has entered its canal in the triceps, they descend as before covered by

the sartorius; the smaller portion is distributed as a cutaneous nerve to the inside of the knee; the larger branch, termed the *nervus saphænus*, descends upon the integuments covering the inner and posterior margin of the tibia, encircles with its branches the vena saphæna major, and terminates upon the inner margin of the instep.

It often happens that the two preceding nerves form one chord till near the knee.

Branches are finally derived from the fourth and fifth lumbar nerves to coalesce with the sacral nerves.

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§ XIV. DISSECTION OF THE SACRAL NERVES.

The sacral nerves are five or six in number, the posterior branches of which as elsewhere are inconsiderable, and are distributed to the muscles and integuments behind the vertebral column. The anterior branches reciprocally coalesce to form the *sacral plexus* upon the margin of the sacrum and the pyriformis muscle.

The greater portion of the sacral plexus is employed in contributing to the ischiatic nerve; but before the dissection of this nerve it may be convenient to dispatch the smaller branches derived from the same source.

The *third sacral nerve* distributes from twelve to sixteen filaments to the hypogastric plexus, and furnishes the long pudic nerve, which passes forwards between the two sacro-sciatic ligaments, and ascends with

the internal pudic artery upon the branch of the ischium to the organs of generation, which it supplies.

The *fourth sacral nerve* specially supplies the coccygeus, the sphincter externus ani, and the adjoining integuments.

The *fifth sacral nerve* is distributed to the levator ani, and to the same surface with the fourth.

Again, the sacral plexus gives off as separate branches,

1. A *ramus interior*, which leaves the pelvis at the sciatic notch, and re-enters it below the spine of the ischium to supply the obturator internus.

2. A *ramus profundus*, distributed to the gemelli and quadratus femoris.

3. A *ramus glutæus superior*, which emerges from the sciatic notch above the pyriformis, and is distributed to the glutæus maximus and integuments.

4. A *ramus glutæus inferior*, which emerges below the pyriformis, and is distributed to the glutæus medius, the glutæus minimus, and tensor vaginæ femoris.

Of the sciatic nerve.

The *sciatic nerve*, the largest in the human frame, is formed from the anterior branches of the two lowest lumbar and of the three uppermost sacral nerves before the pyriformis muscle: sometimes a portion of the nerve perforates the pyriformis, but generally the entire sciatic nerve emerges from the pelvis below that muscle, and descends vertically behind the remaining rotators of the thigh, being covered by the lower portion of the glutæus maximus, and the origin of the posterior flexors of the knee. It gives branches to the semiten-

dinosus and semimembranosus, to the two portions of the biceps flexor cruris, to the quadratus femoris, and superior and inferior cutaneous filaments to the inside and outside of the ham.

The nerve obtains the name of *popliteal* a few inches above the knee-joint, when placed behind the popliteal vessels; in this region it gradually divides into a larger branch, the *tibial* nerve, continuing in a nearly vertical course behind the knee: and a smaller branch, the *fibular nerve*, inclining obliquely outward, and finally turning round the neck of the fibula.

The tibial and fibular nerves each supply a cutaneous branch to the back of the leg.

The *nervus communicans tibialis* descends from the tibial nerve in the furrow between the two portions of the gastrocnemius; in its further course perforates the fascia of the leg, and is gradually inclined towards the outer ancle and margin of the foot.

The *nervus communicans fibularis* is smaller than the preceding, descends superficially upon the integuments covering the outer and back part of the leg, ancle, and instep: one or more of its filaments coalesce with the preceding nerve.

The *fibular nerve* perforates the peroneus longus, supplies that muscle, the peroneus brevis, and the flexor longus digitorum pedis, and divides into a superficial and deep-seated branch distributed as follows:

The *nervus fibularis superficialis* descends on the outside of the extensor longus digitorum, perforates the fascia of the leg midway above the ancle-joint, and divides into an *external* and *internal tarsal branch* which subdivide, and are distributed towards either edge of the instep.

The *nervus fibularis profundus* perforates the extensor longus digitorum pedis, supplies that muscle, the extensor proprius pollicis, and the tibialis anticus; descends before the anterior tibial artery on the outside of the tibialis anticus, passes behind the annular ligament of the ancle-joint, and the tendon of the extensor proprius pollicis pedis upon the instep, and finally supplies the extensor brevis digitorum pedis, the interossei externi, and the integuments.

The *tibial nerve* distributes branches behind the bend of the knee to all the muscles at the back of the leg; descends at first behind and attached to the tibialis posticus: lower down between that muscle and the flexor longus pollicis pedis; and finally, within the ligamentum laciniatum and abductor pollicis pedis, and behind the posterior tibial artery, it divides into the external and internal plantar nerve.

The *external plantar nerve* is the smallest of the two, extends outwards between the flexor brevis digitorum pedis and the flexor accessorius, and is distributed to the muscles and integuments of the outside of the sole of the foot, and in digital branches, not unlike the ulnar nerve in the hand, to either side of the little toe, and to the adjoining side of the fourth toe.

The *internal plantar nerve*, the larger, like the median in the hand, supplies nerves to more than half the muscles and integuments of the sole of the foot, and to the remaining digital margins.

CHAPTER IV.

DISSECTION OF THE BLOOD-VESSELS.

I shall first describe the blood-vessels of the chest and abdomen; but the student who is preparing to dissect an injected extremity, will do well to commence by performing the surgical operations of exposing the large arterial trunks near the aorta. Rules for these operations are to be found prefixed to the descriptions of the carotid, subclavian, axillary, and iliac arteries. The student should further dissect entirely the blood-vessels of the neck and axilla, and those of the parietes of the abdomen, before he dissects the visceral arteries and veins.

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§ I. OF THE BLOOD-VESSELS OF THE CHEST.

Saw the sternum partially through in the median plane, leaving its triangular portion and the xiphoïd cartilage entire; remove the left half of the portion sawed through together with the anterior halves of the second, third, fourth, fifth, and sixth ribs attached to it. Cut away the greater part of the left lung, open the pericardium, and trace the great vessels from the heart.

It may be remarked, that above the umbilicus the great veins are placed before the arteries with which they correspond, and below this point behind them: this circumstance you have already verified as regards the pulmonary vessels in the dissection of the root of

either lung. You will not however find in many cases either a vein or an artery situated directly before or behind its accompanying vessel, but obliquely, so as in addition to be internal or external in relative place. The arteria femoralis superficialis and the arteria poplitea are directly before their accompanying veins, but the arteria femoralis communis is external as well as anterior to the common femoral vein; the subclavian artery is directly behind the subclavian vein, but the carotid artery lies behind and within the internal jugular vein; and the axillary artery behind and without the axillary vein. The venæ cavæ again are to the left of the aorta. The vena cava inferior at the middle of the abdomen is in the same plane with the aorta; below this level it throws its branches behind those of the aorta; but above the umbilicus its renal branches pass before the renal arteries, and the trunk itself perforates the diaphragm in a plane anterior to the aorta. In the chest the two branches of the vena cava superior again are anterior to those of the aorta. General remarks of this description, however trivial they may seem, assist a student in acquiring an exact notion of the relative situation of parts.

In the dissection of the blood-vessels of the visceral cavities, you will find it advantageous to arrange the remarks you will be led to make, according to the following artificial method; or to consider as separate objects of inquiry, 1, the extent, course, and relative place of the main artery; 2, the origin, relative place, and direction of those branches, which are derived from the main artery to the adjoining extremity; 3, the number and course of those branches, which are distributed internally upon the walls of the cavity; 4, the

distribution of the visceral branches; 5, the course of the veins.

I. The AORTA rises behind the pulmonary artery from the left ventricle of the heart, on a level with the cartilage of the third rib of the left side, ascends obliquely towards the right side, being inclined at the same time slightly forwards, and placed before the bifurcation of the trachea. Having reached the level of the cartilage of the second rib of the right side at its junction with the sternum, the aorta is incurvated backwards and towards the left side, and continues ascending upon the left of the trachea till it arrives at the level of the second dorsal vertebra; the aorta now bends downwards so as to come into contact with the left side of the fourth dorsal vertebra. The first part of the aorta, which is thus incurvated, is called its *arch*.

The left bronchus passes below it, and the ductus arteriosus in the fætus, or the ligament which represents it in the adult, extends from the bifurcation of the pulmonary artery to the concave margin of the arch a little behind its centre. The nervus vagus of the left side crosses the aorta at this part, and gives off its recurrent branch which ascends upon the right of the aorta.

From the fourth dorsal vertebra to the ninth the aorta descends upon the left side of the spine, contained in the posterior cavity of the mediastinum: from the ninth to the eleventh it is contained between the diaphragm and spine; and thus from the fourth to the eleventh is aptly called *descending thoracic aorta*.

II. From the upper part and convex margin of the arch of the aorta, three large arteries rise in succession,

which ascend more or less obliquely to perforate the fascia cervicalis profunda, and to be distributed to the head, shoulder, and arm. The central of these vessels is the smallest, and is called the LEFT CAROTID ARTERY. In its ascent it is inclined slightly to the left and backwards. The last of the three is somewhat larger than the preceding, is inclined more obliquely outward and backward, and is called the LEFT SUBCLAVIAN. The first of the three, in the order of their origin, is called the ARTERIA INNOMINATA: in length about two inches, it is inclined to the right as well as upwards. The arteria innominata equals in capacity both the preceding vessels; it terminates by dividing into the RIGHT SUBCLAVIAN and the RIGHT CAROTID ARTERY: the nervus vagus of the right side descends before the origin of the right subclavian artery, and reflects its recurrent branch behind it.

III. The parietal branches of the thoracic aorta are the INTERCOSTAL ARTERIES, and are eight, nine, or ten in number, as they happen to be distributed along the under margins of the eight, nine, or ten lowest ribs. The right intercostals are longer than the left. The two or three uppermost have to ascend, the middle run nearly transversely, and the lowermost descend in their course outwards. Each intercostal artery attaches itself to the inner and under margin of a rib about opposite to its tubercle, having its accompanying vein before and above it, and an intercostal nerve below it: from the angle of the rib forwards the intercostal arteries and nerves are lodged between the outer and inner intercostal muscles upon the intercostal groove. Each intercostal artery gives off,

(α) *Branches* reflected through the intervertebral foramen, *one* to the bones, *one* to the theca, *one* to the spinal chord itself.

(β) *Branches* to the muscles of the back.

(γ) A *branch* less constantly found, which ascends at the angle of the rib to its upper margin, along which it is distributed.

(δ) The *continued trunk* or *inferior costal artery*, is gradually consumed in branches to the neighbouring muscles and integuments, the anterior of which anastomose with branches of the internal mammary.

IV. The visceral branches of the thoracic aorta supply the heart, the lungs, the pericardium, and œsophagus.

The heart is supplied by two CORONARY ARTERIES, which are the first branches of the aorta, and arise from it behind two of its semilunar valves.

1. The RIGHT CORONARY ARTERY passes forwards in the transverse furrow between the right auricle and ventricle, and pursues the same course upon the under surface of the heart till it reaches the longitudinal furrow, along which it takes a new direction to the apex of the heart, being gradually consumed in branches principally distributed to the right auricle and ventricle.

2. The LEFT CORONARY ARTERY emerges between the left auricle and pulmonary artery, and divides into

(α) An *anterior branch*, which passes along the superior longitudinal furrow of the heart to its apex, supplying the left ventricle chiefly;

(β) A *posterior circumflex branch*, which passes to the under surface of the heart in the transverse furrow between the left auricle and ventricle.

3. The lungs are supplied by what are termed BRONCHIAL ARTERIES: these are given off from the upper part of the descending thoracic aorta: are small, and differ in number from two to four in different subjects; they are attached to the bronchi, subdivide with their subdivisions, and are thus distributed through the lungs.

The upper part of the pericardium sometimes receives a branch from the under margin of the arch of the aorta.

5. The ŒSOPHAGEAL ARTERIES are five or six in number, derived at different points to the œsophagus from the descending thoracic aorta.

V. There are three venous trunks in the chest.

1. The VENA CAVA INFERIOR having perforated the centrum tendinosum of the diaphragm, almost immediately opens into the right and inferior corner of the right auricle.

2. The VENA CAVA SUPERIOR traced upwards from the right and superior corner of the right auricle, receives at three inches above the heart the VENA AZYGOS, which bends forwards over the right bronchus to join it. The vena azygos is generally found as a single trunk upon the right side of the spine in the posterior mediastinal cavity; it receives the intercostal, bronchial, and œsophageal veins. Sometimes a second smaller vein ascends upon the left side of the dorsal vertebræ, and finally joins the larger trunk of the right side.

3. The COMMON CORONARY VEIN opens into the right auricle immediately before the Eustachian valve: it is formed by the union of the *left coronary vein* derived from the superior longitudinal and left transverse

furrow, with the *middle coronary vein* derived from the inferior longitudinal furrow, and the *right coronary vein* derived from the right transverse furrow of the heart.

§ II. OF THE BLOOD-VESSELS OF THE ABDOMEN.

I. The aorta becomes ABDOMINAL opposite to the lower margin of the eleventh dorsal vertebra: it descends upon the left of the vertebræ, and terminates by division commonly upon the fourth lumbar vertebra, but sometimes as high as upon the third, and sometimes as low down as the upper margin of the fifth.

II. The two arteries into which the abdominal aorta divides are called COMMON ILIAC ARTERIES; they recede from the median plane at an acute angle, and descend towards the middle of Poupart's ligament: from the point of bifurcation of the aorta, a vessel of the size of a crow quill, called the ARTERIA SACRA MEDIA, creeps upon the vertebral column into the pelvis in the median plane.

III. The parietal branches of the abdominal aorta are the phrenic and lumbar arteries.

1. The PHRENIC or DIAPHRAGMATIC ARTERIES are generally one on either side, derived from the upper part of the abdominal aorta: each ascends before the crus diaphragmatis of the same side, reflecting branches to the stomach, liver, and renal capsules; is inclined obliquely forwards and outwards near the edge of the centrum tendinosum; and is distributed in muscular branches, some of which reach through to the pericardium, others attain the margin of the chest, and anastomose with the internal mammary and intercostal arteries.

2. The LUMBAR ARTERIES comprize five pair: one given off before each lumbar vertebra: each lumbar artery passes outwards, and divides into *anterior branches*, employed in supplying the psoæ and quadratus lumborum; and *posterior branches*, that creep upon the bodies of the vertebræ to the intervertebral foramina, and the muscles of the back, through which they are distributed like the first branches of the intercostal arteries.

IV. The visceral arteries of the abdominal aorta are three pair rising laterally from the aorta, and three single arteries derived from its fore part.

The three pair of arteries are:

1. The ARTERIÆ CAPSULARES, slender twigs sometimes double, or even triple, distributed to the renal capsules and neighbouring surfaces.

2. The EMULGENT OR RENAL ARTERIES, which rise from the aorta upon the second lumbar vertebra, pass outwards to the hilus of the kidney, divide into three or four branches, which subdivide before they plunge into the substance of that viscus.

The emulgent arteries in their course give twigs to the neighbouring parts.

3. The SPERMATIC ARTERIES, which are given off a little below the renal arteries; that of the right side sometimes rises from the right emulgent: these vessels descend upon the iliac fascia towards either internal ring to form part of the spermatic chord, and to supply the testis.

The three single arteries, which rise from the fore part of the abdominal aorta, are:

1. The CÆLIAC ARTERY, given off before the lowest dorsal vertebra, a short capacious trunk half an inch

in length, which terminates in a right branch called the hepatic artery, a central branch called the coronaria ventriculi, and a left, the splenic artery.

(A) The CORONARIA VENTRICULI, the central and smallest branch, passes forwards to the stomach, and divides into the *left coronary* branch, which follows the greater curvature of the stomach, and the *right coronary*, which is distributed along the lesser curvature as far as the pylorus.

(B) The SPLENIC ARTERY is tortuous, passes transversely to the left, and gives off in its course to the spleen, which it supplies,

- (α) *Pancreatic branches*, one larger than the rest.
- (β) *Branches* to the stomach, of which the largest is called the *Gastro-epiploïca* sinistra, distributed as well to the great omentum.
- (γ) *Vasa brevia*, four or five branches reflected from the subdivisions of the splenic artery to the stomach.

(C) The HEPATIC ARTERY passes towards the right, and terminates in the following branches, independently of such small twigs as are not constant enough to deserve notice.

- (α) The *arteria duodeno-gastrica*, which passes between the commencement of the duodenum and the pancreas, giving off the *pylorica inferior*, the *duodena superior dextra*, and the *pancreatico-duodenalis* (which is interposed between the duodenum and head of the pancreas, supplying both), to terminate in the omentum majus under the name of *Gastro-epiploïca dextra*.
- (β) The *arteria pylorica superior*.

(γ) The *Hepatica sinistra*, which passes along the capsule of Glisson to be distributed to the left lobe of the liver.

(δ) The *Hepatica dextra*, larger than the preceding, from which are derived one or two *cystic arteries* to the gall bladder, in its course along the capsule of Glisson to the transverse fissure of the liver.

2. The SUPERIOR MESENTERIC ARTERY is given off from the aorta upon the first lumbar vertebra; it descends behind the pancreas, and pursues a course along the root of the mesentery in such a manner that it supplies from one surface the small intestines; from another, the ascending and transverse portions of the colon.

Its branches are:

(α) *Posterior pancreatic arteries.*

(β) *Inferior duodenal arteries*, two or three in number.

(γ) *Mesenteric arteries*, from twelve to twenty in number, which supply the jejunum and ileum, subdividing and anastomosing reciprocally five times before they reach the margin of the intestine.

(δ) The *arteria ileo-colica*, or continuation of the trunk placed intermediately between the mesenteric and mesocolic arteries, gives branches to the cæcum and appendix cæci vermiformis.

(ε) The *arteria colica dextra* passes in the mesocolon towards the ascending part of the colon.

(ζ) The *arteria colica media* passes in the mesocolon towards the arch of the colon.

The two preceding vessels give off anastomotic branches on either hand, by which they are reciprocally connected, and unite with the arteria ileo-colica on the right, and with the colica sinistra upon the left.

3. The INFERIOR MESENTERIC ARTERY is given off from the aorta rather less than an inch above its termination, it descends in contact with the aorta, but is inclined somewhat to the left, and finally terminates by division into

(α) The *colica sinistra*, which is distributed by *ascending*, *transverse*, and *descending branches* to the descending portion and sigmoïd flexure of the colon.

(β) The *hemorrhoïdalis interna* distributed to the rectum.

V. The great venous trunk of the abdomen is the VENA CAVA INFERIOR, which ascends upon the right side of the spine to its foramen in the centrum tendinosum of the diaphragm. The vena cava inferior terminates below or is formed by the two common iliac veins somewhat below the bifurcation of the aorta. It receives, during its ascent, the lumbar and phrenic veins, the emulgent veins, one from each side, the spermatic veins, of which there are two on each side, one commonly entering the emulgent vein of the same side, and the veins of the renal capsules.

The ventricular, splenic, duodenal, pancreatic, superior and inferior mesenteric veins, those, namely, which belong to the three single visceral branches of the aorta, unite to form another trunk, called the VENA PORTÆ. The vena portæ ascends behind the ducts and arteries of the liver, involved in the capsule of

Glisson, to the transverse fissure of the liver, in which viscus it subdivides and is distributed like an artery. The blood carried into the liver either by this vessel or by the hepatic arteries, is finally conveyed out of the liver by means of three or four large veins termed *venæ cavæ hepaticæ*, which open from the centre of the posterior margin of the liver directly into the vena cava ascendens.

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§ III. OF THE BLOOD-VESSELS OF THE NECK.

A SUPERFICIAL VEIN, called the EXTERNAL JUGULAR VEIN, descends within the platysma myoïdes from the base of the lower jaw, or the side of the occiput to the clavicle, and dipping inwards behind the posterior margin of the sterno-cleido-mastoïdeus muscle, opens into the subclavian vein. Sometimes there are two; in which case the anterior, joined by the superficial thyreoïd veins, dips inward before the sterno-cleido-mastoïdeus, and opens into the internal jugular vein.

When the external jugular vein is opened in the living body, accidentally or by design, care must be taken by closing the vein below the orifice, to prevent the inhalation of air into the heart during inspiration, which proves fatal. A case is mentioned in Majendie's Physiological Journal, in which, during an operation for the removal of a tumor in the neck, death ensued from this cause.

The deep-seated vessels of the neck are the internal jugular vein and the common carotid artery, which are

lodged in the angular groove formed on either side by the apposition of the windpipe and gullet to the vertebral column. Let the head be turned towards the opposite side. Draw a line from the upper margin of the sternal end of the clavicle to the angle of the jaw. The COMMON CAROTID ARTERY lies at some depth directly behind this line, in which an incision about two inches in length may be made, if you wish to expose the artery at any given point. In your present dissection, divide the skin and platysma myoïdes for the whole length of the line described. You notice, that the two lower thirds of your incision have exposed the substance of the sterno-cleido-mastoïdeus muscle, and that the upper third has exposed the fascia cervicalis superficialis. Evert the anterior edge of the sterno-cleido-mastoïdeus, so as to expose the fascia cervicalis for the whole line, in which you have divided the skin. A third of this distance above the clavicle the omo-hyoïdeus is seen to traverse obliquely this line, which the nervus descendens noni follows with some exactness, being immediately external to the sheath of the vessels.

You have now to examine the relative place of the artery, vein, and nervus vagus, which are involved in a common covering of tough cellular texture, derived from the fascia cervicalis superficialis. The vein is situated before and without the artery; the nervus vagus between the two, but rather backward. The sympathetic nerve is placed between the sheath of the vessels and the vertebral column; the muscles, which are interposed between the vertebræ and the vessels, are the rectus capitis anticus major above, and below, the longus colli. To expose the artery, the vein and nerve may be drawn outwards by means of a blunt

hook. It is obviously expedient in operations for tying arteries, to strip the artery for as small a space as possible. The best instrument for passing a ligature round an artery, is the very ingenious contrivance of Mr. Weiss.

At the upper margin of the thyreoïd cartilage, or a little higher, the common carotid artery, having previously given off no branches, divides into the external and internal carotid arteries, the former smaller than and anterior to the latter.

The EXTERNAL CAROTID ARTERY ascends nearly in the line already described, being but slightly bent forward at its rise. This artery is deeply seated: the stylo-hyoïdeus and biventer maxillæ inferioris, with the ninth nerve, cross over it, below or nearly opposite to the angle of the jaw; and the parotid gland covers it, and partially incloses it. After having given off six branches, the external carotid terminates by division, within the posterior margin of the ascending branch of the lower jaw, at a third of its length from the glenoïd cavity. Blocks should be placed beneath the neck and shoulders of the body at this period of the dissection, by which means the head will be strained backward: the head should, in addition, be rotated towards the opposite side.

You may now dissect off the fascia cervicalis superficialis from the upper part of the neck, and thus expose the various muscles, nerves, and glands connected with or adjoining the os hyoïdes and the angle of the lower jaw, with the branches of the external carotid distributed among them in the following order:

I. The UPPER THYREOÏD ARTERY rises from the external carotid immediately above the bifurcation of the common trunk. It descends obliquely forward to the upper and posterior corner of the thyreoïd gland, at an acute angle with the common carotid artery: from it are derived,

(α) *Muscular branches*, by one or two trunks supplying indiscriminately the muscles and integuments at the fore part and side of the neck.

(β) A *laryngeal branch*, which, with the internal laryngeal nerve, passes towards the larynx between the inferior and middle constrictors of the pharynx, plunges inwards between the thyreoïd and cricoïd cartilages, and supplies the cartilages, muscles, and mucous surface of the larynx.

(γ) A *proper thyreoïd branch*, or the continued trunk, the branches of which are distributed along the upper and posterior margins of the gland and through its substance.

II. The LINGUAL ARTERY rises immediately after the preceding, passes forward between the constrictor medius pharyngis and the hyoglossus; and finally, is continued onward to the tip of the tongue immediately below the lingualis, and to the outside of the genio-hyoglossus, in the fibres of which it is partly involved: from it are derived,

(α) A *descending branch* to the os hyoïdes, and muscles attached to it.

(β) A *dorsal branch* to the upper surface of the tongue near the insertion of the stylo-hyoïdeus.

(γ) A *sublingual branch* to the gland of the same name, and adjoining muscles; when wanting, its place is supplied by a branch from the submental.

(δ) The continued trunk, commonly called *arteria ranina*, passes directly forwards to the tip of the tongue near to its under surface, and by the side of the frænum linguæ.

III. The FACIAL, or EXTERNAL MAXILLARY ARTERY, rises either by a common trunk with the preceding, or immediately after it, and passes forwards covered by the submaxillary gland to the base of the jaw, over which it turns, immediately before the insertion of the anterior fibres of the masseter. In this course it gives off,

(α) The *arteria palatina ascendens*, to the side of the pharynx and the soft palate.

(β) The *arteria tonsillaris*, a similar branch to the preceding.

(γ) *Branches* to the submaxillary gland.

(δ) One or more *branches* to the pterygoïdeus internus.

(ε) The *arteria submentalis*, which passes forwards to the symphysis of the jaw between the anterior portion of the biventer maxillæ inferioris and the mylo-hyoïdeus, turns over the margin of the jaw, and is distributed by a *superficial* and a *deep-seated branch* to the muscles and integuments of the chin.

The facial artery, having turned over the margin of the jaw, ascends obliquely forwards to the ala of the nose through the muscles inserted at the angle of the mouth ; giving off in succession,

(ζ) A *masseteric branch*, reflected backwards to the buccinator, to the small glandular bodies called glandulæ buccales, which are interposed between that muscle and the mucous membrane of the mouth, and to the masseter.

(η) The *arteria labialis inferior*, which passes forwards to the flesh and integuments of the under lip.

(θ) The *arteria coronaria labii inferioris*, which passes within the under lip among the innermost fibres of the orbicularis oris to supply that muscle, the small glandular bodies called *glandulæ labiales*, and the *mucous membrane*.

(ι) The *arteria coronoria labii superioris*, frequently given off by a common trunk with the preceding; it is distributed within the upper lip, as the preceding within the lower.

(κ) The *arteria nasalis*, which is distributed to the side of the nose, and sends twigs towards the lower and inner margin of the orbit.

IV. The ARTERIA PHARYNGEA ASCENDENS, is given off from the posterior surface of the external carotid artery opposite to the lingual: it ascends upon the side of the pharynx, upon which and the adjacent parts it is distributed.

V. The ARTERIA OCCIPITALIS ascends obliquely backwards between the transverse process of the atlas and the temporal bone, in a groove of which it is lodged: further backwards the artery is contained between the trachelo-mastoïdeus and obliquus capitis superior, then between the splenii and complexus,

having given off various branches in its course to the neighbouring parts; but principally

(α) A *meningeal branch*, which enters the cranium at the foramen lacerum inferius.

(β) The *arteria princeps cervicalis*, which descends in the neck between the splenii and the complexus.

The occipital artery emerges at the posterior margin of the splenius capitis, and ascends to be distributed upon the occiput in numerous branches.

VI. The AURICULAR ARTERY ascends obliquely backwards and outwards in the interval between the parotid gland and the mastoïd process of the temporal bone, and between the stylo-hyoïdeus and the posterior attachment of the biventer maxillæ inferioris; where it gives off a *stylomastoïd branch*, which passes towards the tympanum along the aqueduct of Fallopius, and is distributed to the membrana tympani and internal ear. The auricular artery finally ascends upon the convex surface of the cartilage of the ear, which its numerous branches perforate.

At a third of the length of the branch of the lower jaw from the glenoïd cavity, the external carotid artery, covered by the parotid gland, terminates by division into the temporal and internal maxillary arteries.

VII. The ARTERIA TEMPORALIS ascends towards the root of the zygoma, where, emerging from below the parotid gland, it becomes subcutaneous, having previously given off,

(α) An *articular branch* to the joint of the lower jaw.

(β) *Masseteric branches.*

(γ) The *arteria transversalis faciei*, frequently of considerable size, which passes forward upon the masseter near the duct of the parotid and middle branches of the portio dura, to supply the cheek.

(δ) The *temporalis profunda media*, which ascends upon the zygoma, and immediately perforating the temporal fascia, is distributed to the muscle of the same name.

(ε) *Anterior auricular branches.*

The temporal artery, passing over the root of the zygoma, gives off,

(ζ) A *ramus orbicularis* to the upper margin of the orbit;

and finally, divides into;

(η) The *anterior superficial temporal*, of which the preceding is often a branch; and

(θ) The *posterior superficial temporal.*

VIII. The INTERNAL MAXILLARY ARTERY requires for its exposure, that the lower jaw should be sawed through before the insertion of the masseter, and the detached portion turned outwards. The internal maxillary artery ascends obliquely forward and inward, to reach in a short and tortuous course the spheno-maxillary fissure, passing externally to the third division of the fifth nerve, and between the two pterygoïd muscles: it is consumed in the following branches given off as it passes each surface, from which they derive their names.

(α) A *deep articular branch.*

(β) A branch through the glenoïd fissure to the *tympanum.*

(γ) An *arteria meningea parva,* which passes through the foramen ovale.

(δ) The *arteria meningea media,* which enters the skull through the foramen spinale, and spreads upon the side of the dura mater, frequently furnishing the arteria meningea anterior.

(ε) The *inferior maxillary artery,* which passes with the nervus mandibulo-labialis into the dental canal, to supply the alveoli of the lower jaw.

(ζ) *Pterygoïd branches.*

(η) The *arteria temporalis profunda posterior* to the temporal muscle.

(θ) The *arteria temporalis profunda anterior.*

(ι) The *arteria buccalis,* which descends in a like direction with the buccinator nerve.

(κ) The *alveolar artery,* which descends upon the outer and back part of the superior maxillary bone to the alveoli of the upper jaw.

(λ) The *infra-orbital artery,* which accompanies the second division of the fifth through the infra-ōrbital canal.

(μ) The *arteria palatina descendens.*

(ν) The *arteria pharyngea descendens.*

(ξ) The *nasal branch,* or continued trunk of the artery, distributed to the upper and back part of the cavity of the nostril.

§ IV. OF THE ARTERIES OF THE BRAIN.

The arteries of the brain are derived from two sources; the *common carotid* namely, and the *vertebral*, a branch of the subclavian. They are remarkable for their anastomotic union upon the base of the brain, for the double curve which either makes before reaching the cranial cavity, and for the thinness of their coats. The former provision seems intended to break the force of the blood entering the brain; the latter, in the economy of the body, is consistent with the diminished force of the circulation in this part.

I. The INTERNAL CAROTID ARTERY ascends in the neck to the canalis caroticus, having the stylo-glossus and stylo-pharyngeus muscles, and the glosso-pharyngeal nerve interposed between it and the external carotid artery. The ninth nerve passes outwards between the internal carotid artery and the jugular vein. The sympathetic is placed between these vessels and the spine. In the canalis caroticus, the sympathetic is distributed as a plexus round the internal carotid artery, which in this channel of the temporal bone completes its first curve. Its second curve is lodged in the cavernous sinus, to which it distributes an *anterior* and a *posterior branch;* finally, the internal carotid artery perforates the dura mater at the side of the sella turcica, and gives off, besides inconsiderable twigs to the pituitary gland and infundibulum, the following branches:

1. The ARTERIA OPHTHALMICA, which enters the orbit through the foramen opticum below and without

the optic nerve; the further course of the ophthalmic artery lies above the optic nerve towards the inner canthus of the eye; it gives off many branches, which, though small, are sufficiently regular to have names appropriated to each, which describe their distribution:

(α) The *arteria centralis retina*, which perforates the optic nerve, and passes along its axis into the eyeball, and is distributed arborescently upon the internal membrane of the retina.

(β) The *arteria lacrymalis*.

(γ) The *arteria supra-orbitalis*, or *muscularis superior*, which passes along with the frontal nerve through the supra-orbital foramen to the forehead.

(δ) The *inferior muscular artery*, contrasted with the preceding.

(ε) The *ciliary arteries* are very numerous; they supply the ball of the eye: they are derived in part from the ophthalmic artery, in part from its branches. There are three orders of ciliary arteries: *arteriæ ciliares breves*, nearly thirty in number, which perforate the sclerotic coat near the optic nerve; *ciliares longæ*, two in number, which perforate the sclerotic coat at a third of its breadth from the nerve; and lastly, the *ciliares anteriores*, four or five in number, which enter the eye at no great distance from the cornea.

(ζ) The *arteria ethmoïdalis anterior*, which passes through the foramen orbitale internum anterius.

(η) The *arteria ethmoïdalis posterior*, which passes

through the foramen orbitale internum posterius.

(θ) The *arteria palpebralis inferior.*

(ι) The *arteria palpebralis superior.*

(κ) The *arteria nasalis.*

(λ) The *arteria frontalis.*

2. The ARTERIA COMMUNICANS, which is reflected backwards on the outside of the crus cerebri to anastomose with the *arteria cerebri posterior* derived from the basilar, by which means the *circulus arteriosus Willisii* is completed laterally.

3. The ARTERIA CEREBRI MEDIA, which ascends obliquely outwards in the fossa Sylvii, and supplies the outer part of the brain.

4. The ARTERIA CEREBRI ANTERIOR, which ascends obliquely forwards and inwards towards its fellow, with which it enters the median fissure of the brain, and turning over the anterior margin of the corpus callosum, passes backwards upon its convex surface, supplying the inner convolutions of the brain. The *circulus arteriosus Willisii* is completed at the fore part by means of a large vessel half an inch in extent, which joins transversely the arteriæ anteriores cerebri below the anterior margin of the corpus callosum, and is called their *communicating branch.*

II. The VERTEBRAL ARTERY is found at the upper part of the neck, lodged in a canal formed by the successive perforations in the transverse processes of the cervical vertebræ: its two curves are found between the dentata and the atlas, and between the atlas and the occiput: the incurvations of the artery have in this case a second object; they preserve the vessel from violence

during extreme rotation or inclination of the head either way. During these movements, the arteries, from being curved, are straightened, which if their course had been straight originally, would have been now prejudicially stretched: from the uppermost curve the *arteria meningea posterior* is derived.

The vertebral arteries ascend obliquely inwards before the medulla oblongata to anastomose at the lower margin of the pons Varolii, and form the *basilar artery*; giving off in their course,

1. The ARTERIA INFERIOR CEREBELLI, which, turning round the corpus restiforme, passes to the processus vermiformis inferior, and to the fourth ventricle.

2. The ARTERIA SPINALIS POSTERIOR, often given off from the last, descends upon the back part of the spinal chord to its termination, being continually reinforced by branches entering along the passages of the nerves.

3. The ARTERIA SPINALIS ANTERIOR, descends in a similar way upon the fore part of the spinal chord, continually connecting itself with its fellow by means of anastomotic branches.

The BASILAR ARTERY ascends obliquely in the median plane, lodged in the basilar furrow of the pons Varolii, at the anterior margin of which it terminates in four branches, two to either side. These are,

4. The ARTERIA CEREBELLI SUPERIOR, which turns round the crus cerebri to reach the upper surface of the cerebellum.

5. The ARTERIA CEREBRI POSTERIOR, which passes at first in a course nearly parallel to the preceding, receives the arteria communicans of the internal

carotid, and is then distributed upon the under part and outside of the posterior lobe of the brain.

The *circulus arteriosus Willisii* is thus completed by the union of the arteriæ cerebri posteriores in the basilar.

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§ V. OF THE SUBCLAVIAN ARTERY AND VEIN.

The *subclavian artery* of either side describes a curve, ascending from the arteria innominata or from the arch of the aorta obliquely outwards, passing over the first rib between two of the scaleni muscles, and finally sloping downwards behind the clavicle towards the axilla: when it has passed the clavicle, the name of the arterial trunk is changed to *axillary*. The subclavian artery is thus situated, 1, within the scaleni; 2, between the anterior and middle scalenus; and 3, external to the scaleni.

The subclavian vein is placed before and parallel to the subclavian artery, the scalenus anticus being interposed between these vessels. The nervus vagus again, and the phrenic nerve and cardiac branches of the sympathetic, descend between these vessels into the chest. The trunk of the sympathetic descends behind the subclavian artery. The nerves of the axillary plexus are found behind that part of the subclavian artery which is external to the scaleni.

It may be requisite to tie the subclavian artery within the scaleni: for this purpose, the lower part of the incision upon the common carotid already described is to be made, the sternal attachment of the sterno-

cleido-mastoïdeus to be cut through, and the sheath of the vessels of the neck drawn inwards by means of a blunt hook. The course of the first rib is a ready guide to the artery, which turns over it somewhat before its centre.

Or it may be requisite to tie the subclavian artery external to the scaleni. To this case the following directions apply: the subclavian artery descends obliquely behind the clavicle at the distance of two-fifths of the length of that bone from its sternal extremity. Draw the integuments of the neck downwards upon the clavicle, so that the skin, habitually situated half an inch higher than that bone, now cover it. Make an incision five inches in length through these integuments upon the clavicle, the centre of which incision is to be the point behind which the artery passes. By this means the skin and platysma myoïdes are divided without endangering the external jugular vein. Adipose substance, and the lateral prolongation of the fascia cervicalis superficialis behind the outer margin of the sterno-cleido-mastoïdeus alone remain to be carefully divided by means of the director and scalpel: the external jugular vein is to be pressed inwards by means of a blunt hook, as well as the omo-hyoïdeus muscle, if it interfere with the progress of the operation. The point of the clavicle already alluded to is a certain guide to the place of the artery, which lies between the subclavian vein and axillary nerves, but not in contact with either.

The branches derived from the subclavian artery are eight in number: two of which descend into the chest, completing its parietal vessels: two ascend as visceral arteries in the neck, to the thyreoïd gland and

brain; two ascend as muscular arteries of the neck; two pass transversely outwards towards the shoulder.

1. The ARTERIA MAMMARIA INTERNA rises from the upper and fore part of the internal portion of the subclavian, and then bending forward and downward, reaches the edge of the anterior mediastinal cavity, along which it descends to the diaphragm with an accompanying vein on its inside, and a plexus of absorbent vessels and glands: it is throughout situated behind the sternal attachments of the cartilages of the ribs, and at the lower part of the chest is interposed between the internal intercostal muscles, and the triangularis sterni. Its branches are given off in succession to the surfaces it passes by, and are,

(α) A *reflected branch* to the neck.

(β) An *arteria thymica*.

(γ) The *arteria comes nervi phrenici*, which reaches the diaphragm.

(δ) *Pericardiac branches*, the lowest of which reaches the diaphragm.

(ε) *Branches*, which emerge between the cartilages of the ribs, and anastomose with the intercostal arteries.

(ζ) The *arteria musculo-phrenica*, a large branch given off opposite the sixth rib to the intercostal muscles and diaphragm.

(η) The continued trunk, or *ramus epigastricus*, emerges from the chest at the side of the xiphoïd cartilage, and terminates in an *internal* and an *external branch*, the former distributed to the rectus, the latter to the transversus abdominis, both anastomosing with

the extremities of the *arteria epigastrica* of the external iliac.

2. The SUPERIOR INTERCOSTAL ARTERY rises from the upper and posterior surface of the subclavian, without the origin of the two arteries next described, is inclined backwards and upwards, and then abruptly bent downwards to the neck of the first rib: it gives twigs to the surfaces in its neighbourhood, and terminates in two, three, or four vessels, which are distributed along the lower margins of as many uppermost ribs in the same manner as the aortic intercostals below.

The mammaria interna and superior intercostal artery are the two parietal thoracic branches of the subclavian.

3. The INFERIOR THYREOÏD ARTERY rises from the upper margin of the subclavian a little within the preceding; ascends upon the longus colli to somewhat higher than the lower margin of the thyreoïd gland, towards which it is finally incurvated downwards and inwards, and consumed in its substance. The inferior thyreoïd artery is of a large size; *one* of the muscular arteries of the neck is *always*, and *three frequently* are derived from it: in addition, it distributes twigs to the scalenus anticus, longus colli, to the lower cervical vertebræ, to the œsophagus and trachea. It lies behind the sheath of the jugular vessels, and may be readily found in its transverse course to the thyreoïd gland, upon drawing to the outside the common carotid artery.

4. The VERTEBRAL ARTERY rises from the upper and back part of the subclavian, ascends upon the longus colli, involved in the branches of the sympathetic nerve, dips backward between the transverse processes of the upper dorsal and seventh cervical vertebræ, or

between two of the lower vertebræ of the neck; and finally ascends in the canal formed by the foramina in the cervical transverse processes to the foramen magnum: during its passage along the neck, the vertebral artery gives off twigs to the neighbouring parts, to the theca vertebralis and to the spine: its cerebral distribution has been already described.

The inferior thyreoïd and vertebral arteries are the two visceral branches of the subclavian, and with the two preceding are invariably given off within the scaleni.

The two following are the ascending muscular arteries of the neck, and are as regular as the preceding in their origin and distribution:

5. The CERVICALIS ASCENDENS ANTERIOR always rises by a common trunk with, or as a branch of the ascending thyreoïd artery: it ascends in the interval between the scalenus anticus and the rectus capitis anticus major, to be distributed upon the muscles and nerves on the side and fore part of the cervical vertebræ.

6. The CERVICALIS ASCENDENS POSTERIOR always rises as a separate branch from the upper margin of the subclavian artery, behind the scalenus anticus: it dips backwards between the transverse processes of the fifth and sixth cervical vertebræ, distributing twigs to the parts it passes by, and finally ascends between the complexus and the semispinalis colli to supply these and the adjoining muscles.

The two arteries derived from the subclavian, that pass transversely outwards, are exceedingly variable in their mode of origin: sometimes both arise from the inferior thyreoïd artery; sometimes one, sometimes the other: when not thence derived, these

arteries spring from the subclavian on the outside of the scaleni muscles. The first of the two in the arrangement followed is sometimes wanting, and is sometimes double.

7. The ARTERIA TRANSVERSALIS COLLI passes transversely towards the shoulder before the axillary nerves: it is distributed partly in branches, which pass forwards behind the clavicle, in greater part by branches distributed to the brachial nerves, the trapezius, the levator scapulæ, and parts adjoining.

8. The ARTERIA TRANSVERSALIS HUMERI, or SUPRASCAPULARIS, passes generally below the preceding towards the notch of the scapula: it terminates in three principal branches:

(α) The *ramus superficialis baseos scapulæ*, which descends along the base of the scapula between the rhomboïdei and the serratus magnus as far as its inferior angle.

(β) The *ramus dorsalis scapulæ*, which passes backwards to the trapezius and spine of the scapula.

(γ) The *ramus supraspinatus*, which passes towards and through the notch of the scapula, and is distributed to the muscle of the same name, and upon the capsular ligament of the shoulder-joint.

§ VI. OF THE AXILLARY ARTERY.

To expose this artery at the upper part of the axilla, draw the integuments of the chest upwards upon the clavicle, so that the skin habitually situated half an inch below the clavicle now cover it. Make an inciaion

four inches in length through the skin down to the clavicle, recollecting that the artery passes behind the clavicle at two-fifths of the length of the clavicle from its sternal extremity, and making this the centre of the incision.

The next step in this operation is to detach the clavicular portion of the pectoralis major from its origin for some extent, by which means the interval between the subclavius muscle and the pectoralis minor is exposed. This interval is occupied by a strong fascia, which extends from the under margin of the subclavius muscle to the coracoïd process of the scapula. The axillary artery descends obliquely outwards behind this *subclavian fascia*, having the axillary vein before and below it, and the axillary nerves behind it. The division of the subclavian fascia is to be performed with caution, as a considerable artery, the pectoral branch of the thoracica humeraria, together with the anterior thoracic nerves, cross the incision at this part. The axillary vein, which is first distinguished, is to be pressed inwards and downwards to shew the artery.

The arterial trunk is termed axillary from the lower margin of the clavicle to the lower margin of the pectoralis major: it attaches itself to the surface of the coracobrachialis muscle. The axillary vein divides about the middle of the axilla into two, one of which is subsequently placed on either side of the artery. The brachial plexus of nerves for the upper third of the axilla is placed behind the artery; for the middle third completely encloses it; for the lower third distributes its branches in the following order: the *nervus cutaneus externus* is placed upon the outside of the artery,

which it quits on perforating the coracobrachialis. The *nervus medianus* descends immediately before the artery. The *nervus cutaneus medius* or *internus* is placed upon the inner and fore part of the artery. The *nervus ulnaris* descends on the inside of the artery. The *nervus spiralis* is placed behind the artery, as well as the *subscapular*, for the short space during which they are in contact with it.

The branches of the axillary artery are seven in number.

1. The ARTERIA THORACICA BREVIOR or SUPREMA rises from the inferior margin of the upper part of the artery, and descends obliquely inwards to the first and second intercostal spaces to supply the neighbouring parts.

2. The ARTERIA THORACICA LONGIOR, or MAMMERIA EXTERNA, is larger than the preceding, rises near it, and invariably descends behind the outer margin of the pectoralis minor to the side of the chest: it terminates in,

(α) *Rami pectorales* to the pectoral muscles and mamma.

(β) *Rami alares* to the fat and glands in the axilla, and

(γ) *Rami perforantes*, which perforate the intercostal muscles, supplying these and the serratus magnus in part, and anastomosing with the intercostal vessels.

3. The ARTERIA THORACICA ALARIS, occasionally wanting, is generally smaller than the preceding, beyond which it rises, and is distributed to the fat and glands in the axilla.

4. The ARTERIA THORACICA HUMERARIA or

ACROMIALIS is the largest of the four thoracic arteries: it rises from the fore and upper part of the axillary artery, and ascends obliquely forward between the pectoralis minor and the subclavius: it here divides into,

(α) The *ramus pectoralis*, or *rami pectorales*, which ramify behind the pectoralis major, supply it and through it the mamma and integuments;

(β) The *ramus circumflexus*, which passes outwards towards the interval between the pectoralis major and the deltoïd, descends along that interval, giving twigs to the subclavius, to the spine of the scapula, to the deltoïd muscle, and finally, under the name of *ramusculus cutaneus descendens*, is distributed upon the outer margin of the shoulder.

The cutaneous vein of the outer edge of the forearm, or *vena cephalica*, ascends in the intermuscular space, which contains the preceding arterial branch, to dip inward below the clavicle to join the axillary vein.

5. The ARTERIA SUBSCAPULARIS is the largest branch of the axillary artery: it arises from its inner margin opposite to the neck of the scapula, and descends for two inches along its external costa, when it turns round upon the dorsum of the bone: it distributes the following branches:

(α) A *ramus* or *rami ad subscapularem*.

(β) A *ramus ad costam externam scapulæ*, which supplies the latissimus dorsi in part, and at the inferior angle of the scapula anastomoses with branches of the superficialis baseos scapulæ.

(γ) A *ramus ad teretem* to the teres major.

(δ) The continued trunk, or *ramus circumflexus* turning round the bone enters the substance of the teres minor, and terminates in *ramusculi descendentes*, which again anastomose at the inferior angle of the scapula with branches of the superficialis baseos scapulæ, and *ramusculi ascendentes articulatorii*, which creep upon the bone supplying the teres minor and infraspinatus, and terminate finally by anastomosing with branches of the ramus supraspinatus of the suprascapular artery upon the capsular membrane of the shoulder joint.

6. The ARTERIA CIRCUMFLEXA POSTERIOR is not much less than the preceding, just below which it rises; along with the circumflex nerve this artery passes between the teretes, and between the long head of the triceps extensor cubiti and the humerus, to be distributed to the deltoïd muscle, and adjacent parts.

7. The ARTERIA CIRCUMFLEXA ANTERIOR is a small vessel, and frequently a branch of the preceding: it passes round the fore part of the humerus so as finally, to anastomose with the preceding and supply twigs to the parts by which it passes.

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§ VII. OF THE BRACHIAL ARTERY.

The arterial trunk of the upper extremity is found at the lower part of the axilla attached to the surface of the coracobrachialis muscle: it descends from

thence in a direct line to the middle of the fore part of the elbow-joint, tending towards the fossa between the pronators and supinators of the wrist, at which it divides. From the lower edge of the pectoralis major to its division, the artery is termed BRACHIAL or HUMERAL. As low down as the middle of the humerus the artery continues attached to the coracobrachialis: for the lower half of the humerus it is placed upon the brachialis internus: to within a short distance of the elbow joint the *median nerve* lies *before* the artery, but afterwards *nearer* to the inner condyle. The *middle cutaneous nerve* for more than the upper half of the humerus is internal to the artery, but afterwards, like the median nerve, recedes towards the inner condyle. Immediately above the elbow-joint the artery which hitherto lay behind the humeral fascia is covered by the aponeurosis of the biceps. Its branches are the following:

1. The *arteria profunda humeri*, given off from the inner edge of the artery, often before it has escaped from the axilla, tends with the spiral nerve (which descends parallel to, above, and behind it) to the interval between the brachialis externus and the long head of the triceps extensor cubiti, and gives off,

   (α) The *ramus communicans ulnaris*, which descends before the ulnar nerve upon the edge of the brachialis externus to the back part of the inner condyle.

   (β) *Muscular branches* to the triceps extensor cubiti.

   (γ) The *ramus communicans radialis*, otherwise the continued trunk of the artery, which turns with the spiral nerve round the humerus, and

emerges at the outside of the arm in a *posterior branch*, that descends on the outer edge of the triceps to the back part of the outer condyle, and an *anterior branch*, which descends before the outer condyle with the spiral nerve.

2. RAMI COLLATERALES, two, three, or four, in number, which pursue a parallel course to the ramus communicans ulnaris of the preceding artery, taking its place when wanting, or otherwise reinforcing it by anastomosing branches.

3. MUSCULAR BRANCHES to the coracobrachialis and biceps.

4. The ARTERIA NUTRITIA HUMERI, which rises about the middle of the arm from the outer edge of the brachial artery and enters the substance of the brachialis internus, to which it gives branches before it arrives at its proper foramen in the os brachii.

5. The ARTERIA PROFUNDA MINOR is given off below the preceding, and in like manner enters and supplies the brachialis internus, from the outside of which it emerges, and descends before the outer condyle, supplying muscular and anastomotic branches.

6. The ARTERIA ANASTOMOTICA MAGNA, the last branch of the brachial, rises from its inner edge two or three inches above the bend of the elbow; it passes transversely inwards, and divides into

(α) a *descending branch*, which passes downwards to distribute anastomotic branches among the pronator and flexor muscles before the inner condyle, and

(β) a *transverse branch*, which passes inwards, perforates the edge of the ligament inter-

posed between the brachiales muscles, and coalesces and is distributed with the ramus communicans ulnaris of the profunda humeri superior.

Before the elbow joint the brachial artery divides into an inner larger trunk, the ULNAR, and a lesser outer trunk, the RADIAL ARTERY.

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§ VIII. OF THE ULNAR ARTERY.

The ULNAR ARTERY descends obliquely inwards behind the pronator radii teres and the flexor digitorum sublimis, and immediately before the insertion of the brachialis internus and the flexor digitorum profundus, to the inner edge of the arm, which it attains above its middle. After this the ulnar artery descends before the flexor digitorum profundus to the wrist, in a longitudinal furrow between the flexor carpi ulnaris, and the flexor digitorum sublimis, having an accompanying vein on either side, and the ulnar nerve attached to its ulnar margin. In this course it gives off immediately,

1. The RECURRENT ULNAR ARTERY, which furnishes

(α) a smaller anterior branch, that ascends among the muscles before the inner condyle to communicate with the descending branch of the anastomotica magna humeri; while

(β) the *posterior branch*, or continued trunk, emerges from between the flexores digitorum

upon the back part of the inner condyle, and ascends on the side of the ulnar nerve covered by the upper part of the flexor carpi ulnaris to coalesce with branches derived from above to the same surface from the profunda superior, the collaterales, and the anastomotica magna.

2. The ARTERIA NUTRITIA ULNÆ, which seeks its foramen upon the fore and upper part of the bone.

3. The ARTERIA INTEROSSEA COMMUNIS, which descends upon the interosseous ligament between the flexor digitorum profundus and the flexor longus pollicis, having immediately before it the long branch of the median nerve, which supplies the pronator radii quadratus; it gives off near its origin its first branch, and divides at the upper margin of the pronator radii quadratus into β and γ.

(α) The *arteria interossea posterior suprema* perforates the interosseous membrane above the chorda transversalis humeri, and at the lower margin of the supinator radii brevis, and is distributed in numerous radiating branches to the supinators and extensors of the wrist; one of which, the *arteria recurrens interossea*, invariably ascends behind the outer condyle through the flesh of the anconeus to anastomose with the posterior branch of the ramus communicans radialis of the profunda superior humeri.

(β) The *arteria interossea posterior infima* perforates the interosseous membrane at the upper margin of the pronator radii teres, and distri-

butes its branches towards either edge of the wrist.

(γ) The continued trunk terminates in a similar manner within the pronator radii quadratus upon the interosseous membrane.

4. BRANCHES to the muscles of the fore arm, small, numerous, and irregular.

5. The ARTERIA ULNARIS DORSALIS MANUS rises from the ulnar a short distance above the wrist, descends obliquely inwards and backwards between the flexor carpi ulnaris and the ulna, to be distributed to the inner and back part of the wrist.

The ulnar artery having reached the wrist passes towards the palm of the hand before the ligamentum carpi transversale, having the ulnar nerve still on its ulnar edge, and is finally incurvated towards the lower extremity of the metacarpal bone of the fore finger, constituting the *superficial palmar arch*, the convex margin of which looks downwards: the superficial palmar arch is covered by the palmar fascia, and is anterior to the branches of the median and ulnar nerves. In this final course the ulnar artery supplies,

6. The ARTERIA ULNARIS PROFUNDA MANUS, which dips inward between the origins of the opponens and flexor brevis minimi digiti, to anastomose with the extremity of the radial artery upon the base of the metacarpal bone of the little finger.

From the palmar arch are derived,

7. The ARTERIA VOLARIS MINIMI DIGITI, which descends along the ulnar edge of the little finger behind its accompanying nerve.

8. 9. 10. ARTERIÆ VOLARES DIGITALES, PRIMA, SECUNDA, TERTIA, which pass in succession to the

intervals between the four fingers, and divide before the metacarpal joints, so as to supply a branch to each of the opposite edges of two adjoining fingers.

11. The ulnar artery terminates in a RAMUS ANASTOMOTICUS MAGNUS, or continuation of the palmar arch, by which it joins a branch of the radial.

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§ IX. OF THE RADIAL ARTERY.

The RADIAL ARTERY descends in a straight course from the bifurcation of the brachial artery to the fore and outer part of the wrist, in the longitudinal fossa between the supinator and pronator muscles: for the middle half of the fore arm, the cutaneous branch of the spiral nerve is applied to its outer edge. The radial artery crosses in succession before the tendon of the biceps, the supinator radii brevis, the pronator radii teres, the flexor digitorum sublimis, for the upper half of the fore arm: for the lower half it lies before the flexor longus pollicis manus. No muscle is directly interposed between the radial artery and the fascia of the fore arm.

In this course, besides many irregular muscular branches, the radial artery gives off,

1. The ARTERIA RECURRENS RADIALIS, which rises from its upper part, and is distributed in *descending muscular twigs*, and in *ascending branches*, which anastomose with the profunda minor humeri, and with the communicans radialis of the profunda superior.

2. The ARTERIA SUPERFICIALIS VOLÆ, which rises

at the distance of from one to four inches above the wrist, descends before the ligamentum carpi transversale, and is distributed through the muscles of the thumb.

The radial artery then dips backwards within the styloïd process of the radius, and creeps over the dorsal surface of the naviculare and trapezium to the interval between the bases of the metacarpal bones of the thumb and fore finger.

To expose the artery at this part, feel for the styloïd process of the radius, and the interosseous interval alluded to: extend the thumb and divide the skin in a line between these points, from the projecting tendon of the flexor secundi internodii pollicis to that of the flexor tertii internodii: immediately below the skin one or two branches of the spiral nerve are found, and on turning these aside the radial artery may be exposed upon the bones of the wrist: in this oblique course it gives off,

3. The DORSALIS POLLICIS RADIALIS.

4. The DORSALIS POLLICIS ULNARIS.

5. The DORSALIS CARPEA, which traverses transversely the carpal bones, and from which three *interosseal branches* are derived to the three inner interossei bicipites.

6. The INTEROSSEA INDICIS, which ascends along the dorsal radial surface of the fore finger.

The radial artery then dips forwards between the prior indicis and abductor indicis, in other words between the two portions of the external bicipital interosseous muscle; and thus arriving at the palm of the hand gives off,

7. The ARTERIA PRINCEPS POLLICIS, which ascends before the adductor pollicis in three branches.

(α) The *volaris pollicis radialis* to the radial edge of the thumb.

(β) The *volaris pollicis ulnaris*, to the ulnar edge of the thumb, frequently joined by the extremity of the superficialis volæ.

(γ) The *volaris radialis indicis*, which, joined by the ramus communicans of the palmar arch, supplies the radial edge of the fore finger.

The digital nerves are invariably placed before the digital arteries.

The rest of the radial artery constitutes the *deep-seated palmar arch;* it passes inwards across the bases of the metacarpal bones, distributing numerous branches from either edge, and terminates finally by an union with the ramus profundus manus of the ulnar artery.

The principal varieties that occur in the brachial artery and its branches are the following:

1. The brachial artery sometimes divides at its upper part into two vessels, which descend the one before the other, with the median nerve interposed, to the bend of the elbow. Of the two arteries, the posterior is commonly the ulnar, the anterior the radial; and in this case, the radial artery, when before the elbow-joint, is subcutaneous. Sometimes the anterior artery is the interossea communis.

2. The deep palmar arch is sometimes larger than the superficial, and gives off the volaris digitalis secunda and tertia.

3. The superficial palmar arch is sometimes derived from the interosseal artery.

§ X. OF THE CUTANEOUS VEINS OF THE ARM.

THE veins of the back of the hand turn over either margin of the wrist, and collect into one principal external branch, called VENA CEPHALICA, and one along the ulnar edge of the arm, called VENA BASILICA; the latter is commonly traced to a vein upon the back of the little finger, called *vena salvatella*.

The principal trunk upon the middle and fore part of the fore arm is called the MEDIAN VEIN; below the elbow, the median vein divides into a short oblique trunk, which slopes outwards to join the cephalic vein, and is called the MEDIAN CEPHALIC VEIN; and a similar trunk, which slopes inwards to join the basilic, called the MEDIAN BASILIC VEIN.

These veins are situated immediately below the skin, and cross over or under the branches of the cutaneous nerves of the fore arm.

The CEPHALIC vein continues to ascend on the outside of the arm to the shoulder, where it dips inwards between the pectoralis major and deltoïd to join the subclavian vein.

The BASILIC VEIN, above the inner condyle, associates itself with the brachial artery.

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§ XI. OF THE ILIAC ARTERIES GENERALLY.

THE aorta divides opposite the fourth lumbar vertebra, and to the left of the median plane, into

two equal trunks, called COMMON ILIAC ARTERIES. The vena cava inferior divides half an inch lower, and to the right of the median plane, into the two COMMON ILIAC VEINS, which are situated behind and within the corresponding arteries.

The common iliac artery descends obliquely forwards and outwards upon the inner edge of the psoas magnus towards the middle of Poupart's ligament, and opposite to the sacro-iliac joint divides into a smaller artery, called INTERNAL ILIAC, which descends along the side of the lesser basin of the pelvis parallel to the sacrum; and a larger artery, called EXTERNAL ILIAC, that continues its course along the inner margin of the psoas magnus (to which it is tied down by a layer of the fascia iliaca) as far as Poupart's ligament, behind the middle of which it descends upon the thigh. The external iliac vein lies behind the artery for the most part, but behind and within it near Poupart's ligament.

One method suffices for the exposure of either of the three preceding trunks: divide the integuments of the abdomen by an incision from three to four inches in length, extending obliquely upwards and inwards from a point half an inch above, and to the outside of the ligament of Poupart. In the same line divide the tendon of the external oblique, and the fibres of the internal oblique and transversalis, the latter being previously raised upon a director. Press back the fascia transversalis, and the peritoneum; the external iliac artery is seen upon the inner edge of the psoas magnus. It is obvious, that by following the vessel upwards, you may reach the bifurcation of the common

iliac, so as to be able to apply a ligature to the internal iliac artery, or to the common trunk.

The common iliac artery is about two inches in length, and gives off no branches before its division.

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§ XII. OF THE INTERNAL ILIAC ARTERY.

The INTERNAL ILIAC ARTERY, descending on the inclined plane of the ilium in a line parallel to the curvature of the sacrum, is consumed after a course of about three inches in numerous branches, derived very irregularly from the trunk; 1, to the inner surface of the pelvis; 2, to the viscera within the pelvis; 3, to parts external to the pelvis.

I. The arteries of the first class are the following:

1. The ARTERIA ILIO-LUMBALIS, the first branch of the internal iliac, from which it is reflected upwards at an acute angle between the psoas magnus and the lumbar vertebræ, where it divides into

(α) A *transverse branch*, which passes behind the psoas magnus transversely through the iliacus internus; and

(β) An *ascending branch*, which ascends to the crest of the ilium, distributes vertebral twigs, and is continued outwards along the crest of the ilium between the transversus and the obliquus internus.

2. ARTERIÆ SACRÆ LATERALES, varying from one to four in number at their origin, but distributed upon each bone of the sacrum in *spinal branches*, which dip

inwards through the spinal foramina; and *transverse branches*, which traverse either sacral bone to anastomose with

The ARTERIA SACRA MEDIA, which, derived from the point of bifurcation of the aorta, descends in the median plane to the os coccygis.

II. The arteries of the second class are,

1. The ARTERIA HYPOGASTRICA, or UMBILICALIS, which, not larger in adults than a crow-quill, passes across the ureter to the side and lower part of the bladder, on which it is distributed; an impervious chord is continued from the vessel over the side, and beyond the apex of the bladder to the umbilicus. This chord, till the time of birth, was a large artery, which carried the blood of the fœtus to the placenta.

2. The ARTERIA VESICALIS IMA, distributed to the side and lower part of the bladder, to the prostate gland and vesiculæ seminales: there may be several.

3. The ARTERIA HEMORRHOÏDEA MEDIA, which descends to the rectum, anastomosing with its fellow, and with the hemorrhoïdalis superior of the inferior mesenteric.

III. The arteries of the third class are,

1. The GLUTÆAL, the largest branch of the internal iliac, which emerges from the pelvis through the sciatic notch above the pyriformis, and turns abruptly round the margin of the ilium exactly at the termination of the semilunar line, that marks the interval between the glutæus medius and minimus.

This artery, from its position, is liable to be ruptured by external violence; for which it becomes in most cases necessary to tie either the glutæal artery or the internal iliac. For the latter operation direc-

tions have been already given; to the former the following apply, the correctness of which you may verify in the present instance upon the dead body.

Let the body be laid upon its face, with the hip and knee joints extended as in the erect position, and with the heels and the great toes in contact. Find upon the unaffected side the posterior termination of the crest of the ilium, that is to say, the extreme projection of the ilium towards the sacrum, and the posterior and upper corner of the great trochanter. Imagine a right line connecting these two points divided into fifths: the glutæal artery turns over the margin of the ilium exactly at two-fifths of this line from the posterior projection of the ilium. It may be difficult from the tumefaction to distinguish the points of bone referred to upon the affected side, but it is easy to transfer the result of the preceding calculation made upon the sound side to the opposite. Divide the integuments in the line directed for about five inches, making the point beneath which the artery is situated, the centre of the incision. Divide the glutæus maximus for the same extent in the same direction; the gluteal artery may be immediately secured upon the margin of the ilium between the edges of the pyriformis and the glutæus medius.

Immediately after quitting the pelvis, the GLUTÆAL ARTERY divides into

(α) Its *superficial branch*, which again is distributed by a *lower branch* to the glutæus maximus, by an *upper* to the glutæus maximus and the glutæus medius: twigs from the latter branch anastomose with branches of

the circumflexa ilii over the crest of the ilium.

(β) A *deep-seated branch*, which passes forwards between the glutæus medius and maximus, in two trunks, the *upper* along the linea semilunaris, the *lower* nearer the digital fossa.

2. The SCIATIC ARTERY is contrasted in many points with the preceding; it emerges from the pelvis through the sciatic notch, but at the lower margin of the pyriformis, and terminates in numerous branches, which supply the adjacent parts, but are principally directed backwards and inwards. The sciatic artery, like every other, distributes small branches, which vary in place and number, to the surfaces it passes; but you may especially note

(α) The *ramus coccygeus*.

(β) *Rami glutæi*.

(γ) The *ramus comes nervi ischiadici*.

3. The INTERNAL PUDIC ARTERY, again, emerges from the pelvis through the sciatic notch, below the pyriformis; after which, accompanied by the pudic nerve, it traverses the interval between the two sacro-sciatic ligaments, and finally reascends within the tuberosity and ascending branch of the ischium.

Before leaving the pelvis, the internal pudic artery gives off twigs to the bladder, rectum, and obturator internus: when lodged between the sacro-sciatic ligaments, it distributes numerous twigs to the adjoining muscles, and the last arteries of the bowel, termed

(α) *Hemorrhoideæ externæ*, to the rectum levator ani and integuments.

On emerging from between the sciatic ligaments, the internal pudic artery gives off,

(β) The *arteria perinei superficialis*, which turns over the lower margin of the transversus perinei, and is distributed in a *transverse branch* and an *ascending branch*, to the superficial muscles and integuments of the perineum.

The internal pudic artery is now to be found half an inch behind the margin of the tuberosity and ascending branch of the ischium, covered by the processus falciformis of the posterior sacro-sciatic ligament: in its ascent it gradually advances nearer to the edge of the bone, and becomes finally involved in the substance of the ligament of Camper: it terminates in

(γ) *Branches* distributed to the bulb of the urethra.

(δ) A *deep branch*, which passes the whole length of the substance of the corpus cavernosum of either side, anastomosing with its fellow.

(ε) The *superficialis dorsi penis*, distributed as a subcutaneous artery longitudinally upon the penis.

4. The ARTERIA OBTURATRIX, in four cases out of five, is a branch of the internal iliac, from which it passes downward and forward along with and below the obturator nerve to the aperture at the fore and outer part of the membrana obturans. The principal branch derived from it in this passage is,

(α) The *ramus coronarius*, which is distributed along the upper part of the obturator internus.

The obturatrix artery, on emerging from the pelvis through the membrana obturans, divides into

(β) An *external branch*, which passes outwards

between the two obturator muscles, and is distributed to the parts adjoining the tuberosity of the ischium and the neck of the thigh-bone.

(γ) An *internal branch*, which ascends through the obturator externus to the internal margin of the thyroïd foramen.

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§ XIII. OF THE BRANCHES OF THE EXTERNAL ILIAC.

These are two, which arise from the iliac trunk immediately above Poupart's ligament.

1. The ARTERIA EPIGASTRICA rises from the fore and inner part of the external iliac artery. At first it descends behind the spermatic chord, within which it immediately rises abruptly, being contained in the inner pillar of the internal ring. The epigastric vein ascends internally to the artery.

The principal branch, which the epigastric gives off near its origin, is

(α) *The external spermatic artery*, which accompanies and is distributed to the spermatic chord.

The epigastric artery ascends obliquely inwards towards the umbilicus; considerably below which it divides into,

(β) An *external branch*, which ascends without the semilunar line, and between the transversalis and obliquus internus to the margin of the chest.

(γ) A larger *internal branch*, that ascends immediately behind the rectus, which it supplies; and finally reaching the margin of the chest anastomoses, like the preceding artery, with the corresponding branch of the mammaria interna.

In one case out of five the obturatrix artery rises from the epigastric, in which case it turns over the brim of the pelvis not far from the ligament of Gimbernat, to seek the perforation in the membrana obturans; it is conceivable that there are cases in which, without proper caution during the division of Gimbernat's ligament for the reduction of a crural hernia, this artery might be cut across. The uncertain line of the ascent of the epigastric artery, renders it hazardous to perform the operation of tapping between the linea alba and the linea semilunaris.

2. The ARTERIA CIRCUMFLEXA ILII rises from the outside of the external iliac a little below the epigastric: it ascends obliquely outwards behind Poupart's ligament to the crest of the ilium, along the margin of which it creeps, first between the iliacus internus and transversus, afterwards between the transversus and obliquus internus: it supplies these muscles and anastomoses with branches of the iliolumbalis and of the glutæal; but what is principally worthy of attention, two, three, or four considerable branches frequently ascend obliquely forwards from this artery between the transversus and internal oblique, rendering it unsafe to perform the operation of tapping externally to the linea semilunaris.

XIV. OF THE FEMORAL ARTERY.

As soon as the trunk, hitherto termed external iliac, emerges from behind Poupart's ligament, it obtains the name of COMMON FEMORAL ARTERY. The point behind which the artery passes varies from the centre of the ligament to half an inch internal to it. It is easy in the living body or injected subject to distinguish the exact position of the artery at this part through the integuments.

Bend the hip and knee-joints slightly, rotate and carry the knee slightly outwards. Draw or imagine a line extending from that point of Poupart's ligament behind which the artery passes, to the posterior margin of the inner condyle of the femur. The two upper thirds of this line fall immediately over the femoral artery, and in this line the integuments are to be divided for its exposure.

Divide the integuments for the first three inches of this line, and the subjacent fascia; the COMMON FEMORAL ARTERY is found at the bottom of the oval fossa belonging to the crural arch; the common femoral vein is placed to its inside and behind it, the anterior crural nerve on its outside, and at an inch distance from it, the psoas magnus and iliacus internus muscles intervening.

At an inch or less below Poupart's ligament two, three, or four small vessels, termed EXTERNAL PUDIC ARTERIES, are given off; which distribute branches inwards, upwards, and outwards, to the fat glands and integuments of the groin: one or more of these vessels

is divided by the preceding incision. The common femoral artery varies in length from a third of an inch to an inch and an half: it is commonly found of the latter dimension. It terminates by division into a larger anterior trunk, the ARTERIA FEMORALIS SUPERFICIALIS, which follows the line above described; and a smaller trunk, the ARTERIA FEMORALIS PROFUNDA, which descends behind and a little without the superficial femoral, and is soon consumed in the large branches, which it distributes to the muscles of the thigh.

For the upper third of the thigh the superficial femoral artery is exposed by an incision through the integuments and fasciæ simply: for the same distance the femoralis profunda exists as a considerable trunk, which may require a ligature. To reach the femoralis profunda, it is requisite first to expose the superficial femoral; on drawing which inwards with a blunt hook, the femoralis profunda is found behind it, half an inch of fat perhaps intervening.

For the middle third of the thigh, the superficial femoral artery is covered by the sartorius, which obliquely crosses it.

If it be required to expose the superficial femoral artery in this region, but above the middle of the thigh, you have first to divide the integuments and fasciæ in the line prescribed, by which means you denude the fibres of the sartorius, the *inner* edge of which in this instance is to be everted, when the sheath of the vessels will be seen. If the operation be required below the middle of this region, the outer edge of the sartorius is to be sought and everted, after the longitudinal incision through the skin and fasciæ.

Below the upper part of the thigh the femoral vein lies directly behind the femoral artery: and two large branches of the anterior crural nerve, the internal cutaneous nerve of the knee, and the saphænus nerve, lie before it, the former rather within, the latter somewhat without the artery.

The FEMORALIS PROFUNDA distributes the following branches, the two first immediately upon its origin: it terminates by division into the two last at less than a third of the thigh from Poupart's ligament.

1. The ARTERIA CIRCUMFLEXA EXTERNA passes transversely outwards behind the rectus, the sartorius, the tensor vaginæ femoris, and terminates in

(α) An *ascending branch*, or *trochanterica anterior*, which passes to the digital fossa within the glutæus medius.

(β) *Rami transversi*, which run outwards through the substance of the vastus externus.

(γ) The *ramus descendens major*, which descends obliquely outwards behind the rectus, to which it gives a large branch to attach itself to the anterior edge of the vastus internus, within which it descends, continually distributing branches as low as the knee.

2. The ARTERIA CIRCUMFLEXA INTERNA dips backwards between the psoas magnus and the pectineus; and opposite the interval between the adductor magnus and the adductor brevis divides into,

(α) The *ramus anterior ascendens*, which passes inwards between the adductor brevis and the adductor magnus to be distributed through these muscles to the integuments of the groin; and,

(β) The *ramus posterior circumflexus*, which turns round the neck of the femur at the lower edge of the obturator externus: this artery divides behind the neck of the femur into a *descending branch*, and one that *ascends* obliquely outwards behind the tendon of the obturator externus to the digital fossa, and is called the *arteria trochanterica posterior*.

Thus in the digital fossa branches of the gluteal, sciatic, internal and external circumflex arteries, meet and anastomose.

3. 4. The terminal branches of the profunda femoris are the two RAMI PERFORANTES, vessels of considerable magnitude, which at half an inch distance from each other perforate the adductor magnus, and are distributed in transverse, ascending, and descending branches to the muscles and integuments of the ham.

The RAMUS PERFORANS PRIMUS passes through the adductor magnus about the level of the lower edge of the tendon of the glutæus maximus.

The RAMUS PERFORANS SECUNDUS gives off the arteria nutritia femoris.

The upper edge of the adductor longus intervenes between the femoralis superficialis, and the terminal branches of the profunda.

The FEMORALIS SUPERFICIALIS, for the first part of its course, rarely gives off branches of any magnitude; sometimes a vessel termed the *ramus descendens minor* is derived from its upper part, which attaches itself to the fore part of the vastus internus. Nearly two-thirds down the thigh, the superficial femoral, which hitherto has descended not quite vertically, but in a slight degree inwards and backwards, is received

into an oblique tendinous canal, formed principally in the adductor magnus, but to which the adductor longus and the vastus internus in part contribute: this canal is an inch and an half in length, and transmits the artery to the ham: in this canal are given off,

(α) The *arteria anastomotica magna*, which is given off as the artery enters its canal, and descends along with the nervus saphænus before the tendon of the adductor magnus towards the inner condyle, becoming finally involved in the substance of the vastus internus, in which its three or four large branches are consumed.

(β) Two *perforating branches*, which pass to the ham.

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§ XV. OF THE POPLITEAL ARTERY.

Make a longitudinal incision in the centre of the ham, for three or four inches above the bend of the knee, so as to divide the skin and fasciæ, and to expose the adipose substance in the interval between the biceps flexor cruris and the semitendinosus: on dividing this adipose substance the tibial nerve is seen: draw it with a blunt hook outwards; the sheath of the femoral vessels is placed at some little distance before it, in which the vein is found behind and somewhat external to the artery: for the complete exposure of the artery it is therefore requisite to draw the vein likewise outwards with a blunt hook.

The term POPLITEAL ARTERY is given to the main artery of the lower extremity from the point at which it emerges out of the canal in the adductor magnus to its division behind the knee-joint into the ANTERIOR and POSTERIOR TIBIAL ARTERIES.

The branches of the popliteal artery are:

(α) The *ramus articularis superior externus ascendens.*

(β) The *ramus articularis superior internus ascendens.*

(γ) The *ramus articularis medius*, which subdivides into a branch for either side.

(δ) The *ramus articularis inferior internus.*

(ε) The *ramus articularis inferior externus.*

(ζ) *Rami surales*, distributed to the muscles of the calf of the leg, of which one descends with the nervus communicans tibialis between the two fleshy portions of the gastrocnemius.

The five articular arteries creep forward upon the capsular ligament of the knee-joint, and anastomose reciprocally, and with the ramus descendens major, and with the arteria anastomotica magna, as well as with the recurrens tibialis.

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§ XVI. OF THE ANTERIOR TIBIAL ARTERY.

The division of the popliteal artery takes place behind the bend of the knee, or an inch lower.

The ANTERIOR TIBIAL ARTERY is the smaller of the two thence derived: it generally perforates the membrana interossea at the lower margin of the popli-

teus muscle: its dissection must be undertaken from the fore part of the leg.

The anterior tibial artery is deeply seated: for the upper two-thirds of the leg it adheres to the interosseous membrane: for the lower third of the leg to the adjoining surface of the tibia: again, for the upper two-thirds of the leg the anterior tibial artery lies immediately external to the tibialis anticus muscle.

The following directions will enable you to describe upon the skin the line, behind which the anterior tibial artery descends: draw a line transversely from the spine of the tibia immediately below its tubercle to the outer margin of the fibula, and divide it into thirds: draw another line transversely from the upper part of the anterior margin of the malleolar process of the tibia to that of the fibula and divide it into thirds: draw a right line from the innermost extremity of the outer third of the upper transverse line to the outer extremity of the inner third of the lower: in this line the skin is to be divided for the exposure of the anterior tibial artery at any part of the leg.

After a division of the skin for three inches, the centre of which should be the point at which it is required to tie the artery, the fascia of the leg is to be cut through, not longitudinally only, but transversely, for half an inch on either side, with the double view of enabling the operator to ascertain with precision the intermuscular interval he seeks, as well as to separate with facility the muscles between which the artery lies.

In the upper third of the leg the difficulty of the operation is increased by the circumstance of the muscles taking an origin from the fascia of the leg, whereby it becomes less easy to distinguish the natural separa-

tion between the tibialis anticus and the extensor longus digitorum pedis.

In the middle third of the leg, where this cause of difficulty does not exist, care must be taken not to mistake the interval between the margins of the extensor communis digitorum and of the extensor proprius pollicis pedis, for that between the latter muscle and the tibialis anticus.

In the lower third of the leg the artery is readily found on separating the tendons of the tibialis anticus and of the extensor proprius pollicis pedis, contained between the latter and the bone.

For nearly the whole extent of the leg the deep-seated branch of the fibular nerve lies before the anterior tibial artery.

The branches of the anterior tibial artery are small and very numerous: the following only are constant enough to deserve notice.

(α) The *arteria recurrens tibialis*, which is given off at the upper part of the leg, and perforates the extensor longus digitorum and tibialis anticus in its passage to the inner and fore part of the knee-joint.

(β) The *arteria malleolaris interna*, which is given off near the ancle-joint, and creeps upon the periosteum to the inner malleolus.

(γ) The *arteria malleolaris externa* similarly distributed upon the outside.

The anterior tibial artery at the bend of the ancle crosses obliquely behind the tendon of the extensor proprius pollicis pedis to its outside, and passes forward upon the instep between the tendon last named and that of the extensor communis digitorum. The

course, which the artery pursues, is direct from the point above described towards the interval between the great and second toe: in this course are given off,

(δ) The *arteria tarsea*, which passes obliquely outwards and forwards upon the instep.

(ε) The *arteria metatarsea*, which rising later than the preceding runs a parallel course to it near the bases of the metatarsal bones: from the largest, as may happen, of these arteries, three small interosseous arteries are derived to the three smaller interosseous spaces.

At the interval between the bases of the metatarsal bones of the great and second toe, the anterior tibial artery terminates by division into

(ζ) The *dorsalis externa hallucis*, or innermost interosseous artery, and,

(η) The *ramus profundus anastomoticus*, which dips downwards to the sole of the foot between the bases of the said metatarsal bones.

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§ XVII. OF THE POSTERIOR TIBIAL ARTERY.

The POSTERIOR TIBIAL ARTERY descends along the back part of the leg, not vertically, but continually inclining, though slightly, inward: it is immediately subjacent and adherent to the deep fascia of the back part of the leg described in the muscular dissection. Its exposure is difficult above, easy below the middle of the leg: in either case the incision through the skin should be near and parallel to the inner margin of the

tibia, and conducted with great care, as by pinching up a fold of skin, and then dividing it; in order to avoid the saphæna vein, and saphænus nerve, which are disposed along this surface.

Above the middle of the leg the soleus has to be detached from its tibial origin, and the difficulty of the operation consists in determining when this muscle is divided: after its division the posterior tibial artery, with the nerve to its outside, is readily found upon the outer margin of the flexor longus digitorum pedis, or between that muscle and the tibialis posticus.

Below the middle of the leg, after an incision through the two fasciæ, the posterior tibial artery is found on the outer edge of the common mass formed by the flexor longus digitorum pedis and the tibialis posticus.

The branches of the posterior tibial artery are the following:

(α) The *arteria nutritia tibiæ* derived from its upper part, yielding muscular branches, and finally tending to its foramen on the back of the tibia.

(β) The *arteria peronea*, frequently an artery of great size, descends at first between the margins of the tibialis posticus and flexor longus pollicis pedis: for the upper half of the leg its exposure is accomplished by an operation exactly similar to that described for the posterior tibial artery, but that it is conducted from the *outer* margin of the leg. Below, the exposure of the peroneal artery is more difficult, in as much as instead of descending along the inner margin of the flexor longus

pollicis pedis, the artery frequently creeps upon the inner surface of the fibula, embedded in the fibres of that muscle. Having given off numerous muscular branches and a nutritious artery to the fibula, the peroneal artery divides somewhat below the middle of the leg into a *posterior branch*, which continues in the course of the common trunk, and an *anterior branch*, which perforates the membrana interossea and descends to the outer ancle. Sometimes the latter branch is wanting. Sometimes, on the contrary, it emerges as a large trunk, and, traversing the ancle obliquely inwards, takes the place upon the instep of the anterior tibial artery, which, in such cases, terminates about the bend of the ancle.

(γ) One or more *transverse branches* given off but little above the ancle, which pass outwards to anastomose with the posterior peroneal.

The posterior tibial artery, having arrived at the bend of the ancle-joint, passes within the ligamentum laciniatum towards the sole of the foot: it may readily be found an inch nearly behind the margin of the malleolus internus, following its curve: the posterior tibial nerve lies close and parallel to and behind it at this part. The posterior tibial artery distributes in this region small branches to the malleolus internus, other larger branches towards the os calcis, and finally at the margin of the interval between the flexor brevis digitorum pedis and the flexor accessorius, and covered by the abductor pollicis divides into,

1. The PLANTARIS INTERNA, or smaller branch, which passes forwards under the flexor brevis pollicis pedis to the ball of the great toe, having given off small twigs to the inner margin of the instep, and four large branches in succession, denominated *rami profundi, interior, medius, exterior, extimus*, which creep towards the outer margin of the foot among the muscles and tendons.

2. The PLANTARIS EXTERNA, or larger branch, which passes obliquely outwards and forwards between the flexor brevis digitorum pedis and the flexor accessorius to the base of the metatarsal bone of the little toe, distributing several branches, of which the most remarkable are,

(α) The *ramus transversus anastomoticus*, which creeps across the under surface of the os calcis to the outer margin of the foot.

(β) *Rami profundi*, directed outwards.

The external plantar artery is then incurvated forward and inward below the bases of the metatarsal bones to that of the great toe, constituting the *plantar arch;* from which are derived,

(γ) *Rami interossei profundi*, to the outer of the inferior interossei.

(δ) The *ramus plantaris externus minimi digiti* to the outer edge of the little toe.

(ε) The *ramus plantaris digitalis secundus*, to the interval between the two lesser toes, where it subdivides to supply a branch to either of the adjoining sides: the two next arteries are similarly distributed, and upon the same

principle as in the hand are here *above* the digital nerves.

(ξ) The *ramus plantaris digitalis tertius.*

(η) The *ramus plantaris digitalis quartus.*

The plantar arch having distributed numerous small twigs, besides those named, to the parts which lie in its course, anastomoses with the ramus profundus anastomoticus of the anterior tibial artery, and thus reinforced the artery passes forwards in the interval between the great and second toe; here it is again joined by the extremity of the internal plantar, which sometimes is the largest of the three vessels that contribute to the supply of the great toe: from this source are derived,

(θ) The *ramus pollicaris plantaris internus,* which subdivides like the preceding digital arteries.

(ι) The *ramus plantaris internus halucis.*

(κ) The *ramus dorsalis internus halucis.*

---

§ XVIII. OF THE SUPERFICIAL VEINS OF THE LOWER EXTREMITY.

These coalesce in two large trunks.

The *vena saphœna minor,* ascends in the centre of the back of the leg, covered by the superficial fascia between the two fleshy bellies of the gastrocnemius: it terminates in the popliteal vein.

The *vena saphœna major* commences upon the

inner margin of the instep, ascends upon the subcutaneous surface of the tibia, or adjoining edge of the gastrocnemius, lying external to the fascia: it continues to ascend upon the inside of the knee, and tends to the crural arch, where it dips inwards to join the femoral vein: a second trunk from the fore part of the thigh joins the vena saphœna major just before its termination.

CHAPTER V.

DISSECTION OF THE ABSORBENT VESSELS.

Besides the arteries and veins a third set of vessels is found in the body, which seem derived by extremely fine branches from every part of the body, and collect into trunks, which open into the venous system at the angle formed by the meeting of the internal jugular and subclavian veins on either side.

These vessels, from their supposed use, are termed generally *absorbents:* of which those in the mesentery frequently are found to contain a milky fluid, the chyle, and are called specifically *lacteal vessels:* the absorbent vessels of the rest of the body contain more or less of a transparent fluid, the lymph, and are hence termed *lymphatic vessels.*

Round or oval bodies of various sizes, called *conglobate* or *absorbent glands*, are found in various parts of the body; as for instance, in the neck, axilla, and groin. These are highly vascular, and when cut through seem to have a white nucleus of different structure to the rest. Several absorbent vessels generally enter each gland, and are termed *vasa inferentia;* a smaller number of larger vessels, termed *vasa efferentia*, emerge from the side of the gland nearest the communication with the venous system.

When a large absorbent trunk is slit open, it is found to be furnished with numerous valves resembling

those in veins; or, consisting of two semilunar folds of membrane attached by their convex margins to the circumference of the vessel. It is usual to suppose that each absorbent vessel is resoluble into an internal serous tunic, and an outer contractile and fibrous coat. The absorbent glands seem to be but aggregations of convoluted, dilated, and anastomosing absorbent vessels: such, at least, is the appearance assumed by these parts when injected with mercury.

The absorbents are every where distributed in two sets: one superficial, the other deep-seated. The superficial absorbents of the viscera are readily seen in the recent state of a part, as thin transparent vessels, branching arborescently upon its surface. They become much more distinct, when a viscus has been injected with size and vermilion: they are then tumid, it appears, with uncoloured size: in this way the absorbents are readily shewn upon the liver, spleen, kidney, the heart, and even upon the brain. Upon the parenchymatous viscera, it is easy to inject these vessels with mercury: if a puncture be made into a superficial absorbent vessel in such a case, the stream of mercury will flow against the valves into the branches. Gentle and repeated pressure with the handle of a knife upon the vessel, will assist in urging the mercury forward.

In the limbs, the absorbents resemble in some degree the veins in their distribution; three, four, or five absorbent trunks accompany each artery, and from twenty to fifty lie in the subcutaneous cellular texture of the most protected surface. To see the larger superficial vessels, it is merely requisite to denude an absorbent gland, and on raising it carefully, the vasa inferentia and efferentia will be distinctly seen. The

vasa efferentia are then readily injected. Raise a single vas efferens with the forceps, and puncture it with a lancet, or cut it obliquely half through with fine scissors: then direct the stream of mercury upon the aperture, which will probably be dilated, and allow of the introduction of the point of the injecting tube. Otherwise, the fine wire, with which the injecting tube is cleaned, may be introduced into the punctured vessel, and will serve to guide the stream of mercury.

If it be required to inject the vasa inferentia of the first set of absorbent glands, the task can only be successfully attempted upon a body having little adipose substance, emaciated, and perhaps very slightly œdematous. On removing a portion of skin from the back of the hand, from the wrist, from the instep, in such a subject, the dissector will observe delicate transparent vessels here and there, distinguishable from the veins by their want of connection with them, from the nerves by their absolute pellucidness. These vessels are to be treated in the manner just described as applicable to the larger: but the task in this instance is proportionably more difficult.

A successful dissection, will exhibit from eight to twelve absorbent vessels upon the instep, which, as elsewhere, freely anastomose, or a single vessel divides, and the two parts subsequently reunite: sometimes an absorbent gland is found upon the instep, and always two or three are found behind the inner malleolus; as many as twenty absorbent vessels ascend upon the inside of the leg in the course of the vena saphœna major, being continually reinforced by fresh trunks, which creep inwards from the fore and back part of the leg. This order of vessels continues to

ascend to the groin, where it is received by five to seven superficial inguinal glands.

A smaller set of absorbents ascends with the vena saphœna minor, in part dips profoundly into the ham to join the deep-seated popliteal vessels, upon which three or four absorbent glands are found, and in part joins the former series. The superficial inguinal glands receive, in addition, absorbents from the nates and pudenda, from the abdomen, chest, and loins. Six or seven absorbent vessels are derived from the penis.

Deep-seated inguinal absorbent glands, four or five in number, receive the seven or eight absorbent trunks which accompany the femoral artery.

Beyond Poupart's ligament a continuous plexus of absorbent vessels and glands ascends upon the iliac vessels to the aorta, and upon the aorta into the chest.

The numerous absorbents of the pelvic viscera follow the course of the blood vessels to the aorta.

The absorbents of the great intestine collect into several sets, which accompany each of the meso-colic arteries from the bowel to the aorta.

The absorbents of the small intestines, or the *lacteals*, are extremely numerous, and have no reference in their distribution to that of the blood-vessels. They are observed to be much larger while they ramify upon the bowel, than afterwards in the mesentery. They are received by very numerous mesenteric glands. The lacteals are found to coalesce upon the second or third lumbar vertebra reciprocally, and with the ascending lymphatics, so as to form a capacious sac called the *receptaculum* chyli. From this sac *one* considerable trunk, called the *thoracic duct*, is always con-

tinued upwards, independently of the aortic plexus of absorbents; which in time, however, gradually terminate in it.

The thoracic duct may always be found between the aorta and right crus of the diaphragm: it is sometimes pellucid, sometimes of a dirty red colour. The thoracic duct ascends in the posterior mediastinum upon the dorsal vertebræ, gradually inclining to the left side. At the top of the chest it perforates the fascia cervicalis profunda, ascends behind the subclavian vein, and then arches downwards to open by one or two orifices guarded by valves into the venous angle on the left side.

It sometimes happens, that a branch smaller than the trunk described, is derived from it in the posterior mediastinum to pursue a similar course to the venous angle of the right side.

The absorbents of the stomach, of the spleen, of the under surface of the liver, pass to the thoracic duct, and aortic plexus of lymphatics.

The absorbents of the heart, which follow the course of the coronary arteries, are distributed in part to join the thoracic duct, in part tend to the venous angle of the right side, where two or three short trunks half an inch in length are formed by the coalition of these branches with those from the right side of the head and arm and of the anterior mediastinum.

The absorbents of either lung, which are remarkable upon its surface for their reticular disposition following the areolæ of the lung, and for their occasional dilatations, as well as for the number and dark colour of their glands disposed upon the bronchi and

trachea, are distributed in like manner to either venous angle.

The absorbents from the upper surface of the liver form five or six trunks upon either lobe, which anastomose over the edges of the liver with those upon its under surface, but tend directly in the ligaments of the liver to the diaphragm, which they perforate, and subsequently ascend in two sets, one accompanying either internal mammary artery, to be finally distributed to the absorbent trunks entering the venous angle of the same side.

The superficial absorbents of the upper extremity are readily discovered upon the back of the hand, where as many as seven or eight trunks may be dissected. They thence stream over either edge of the wrist and fore-arm to its inner and forepart, and are continually augmented in number, so as at last to consist of about thirty, which ascend upon the inside of the humerus to the axilla.

Above the elbow joint, two or three lymphatic glands are found: in the axilla more are seen, which are continued in an uninterrupted series behind the clavicle to the root of the neck: to these glands are additionally derived lymphatics from the breast, shoulder and back. The vasa efferentia of these glands upon the left side either join the thoracic duct, or open by one or two short and capacious trunks into the subclavian vein: upon the right side are disposed of in the latter method.

The superficial absorbents of the face and head follow the course of the temporal and facial veins. A great number of very small absorbent glands is

found near the transverse ridge of the os occipitis, and generally one or more is embedded in the parotid gland. The chain of lymphatic glands in the neck distributed along the sheath of the vessels has obtained the name of glandulæ concatenatæ: their vasa efferentia terminate in the same manner as those of the axillary and subclavian glands.

CHAPTER VI.

OF THE CONTENTS OF THE FEMALE PELVIS AND OF THE MAMMA.

In the female body the urinary organs are completely distinct from the generative organs, so that the former appear much more simple than in the male, and the latter form a separate series of viscera interposed in the pelvis between the rectum and the bladder.

The female *urethra* is about two inches in length; it is surrounded by no glandular apparatus analogous to the prostate and glands of Cowper: it terminates on a soft tubercular eminence situated between the labia interna immediately below the symphysis of the pubes. The student should practise upon the dead body the introduction of the female catheter, distinguishing by the touch the aperture of the urethra.

The *vagina* is a mucous passage leading to the *uterus*. The extremity of the uterus, termed the *os tincæ* is to be felt at the upper part of the vagina. The oval orifice of the os tincæ will admit the tip of the finger; and in the natural state a bougie may readily be thus introduced into the cavity of the uterus. The anterior lip or margin of the os tincæ is straight and narrow, and immediately continuous with the upper or anterior surface of the vagina: the posterior margin is thick, and curved, and so projects into the cavity of the vagina, as to leave a shallow fossa between it and the posterior surface of the vagina.

The *uterus* viewed from the pelvis appears somewhat oviform, and is flattened anteriorly. Its upper unattached margin is termed its *fundus;* the narrower cylinder, which extends to the vagina, is called the *cervix uteri:* what lies intermediately between the cervix and fundus is termed the *body* of the uterus.

The peritoneum covers entirely the posterior surface of the uterus and part of the vagina, and is thence reflected over the rectum; but anteriorly is reflected to the bladder from the lower part of the cervix uteri. The peritoneum, derived in a double layer from either side of the uterus, extends transversely to the margins of the lesser basin of the pelvis, forming the *ligamenta lata* of the uterus; which thus separate the lesser basin into an anterior and a posterior chamber.

A round membranous chord termed the *ligamentum teres*, partly contained in a fold of the broad ligament, extends from the fore and upper and lateral surface of the uterus to the internal ring; and after traversing the spermatic passage is lost in the cellular and adipose substance of the external labium.

The round chord, which is contained in the unattached margin of the broad ligament, is termed the *Fallopian tube:* it is about five inches in length, becomes thicker and tortuous at its extremity remote from the uterus, and finally terminates in an irregular fringe of ragged villi or *fimbriæ*, which float in the posterior chamber of the pelvis. This appearance is termed the *morsus diaboli.* The Fallopian tube opens on the one hand into the cavity of the uterus, on the other abruptly upon the peritoneal cavity at the morsus diaboli: at this point the mucous surface of the generative system is continuous with the peritoneum.

A flattened oval body, termed the *ovarium*, is found contained between the two layers of peritoneum, which constitute either broad ligament. Its length somewhat exceeds an inch. In persons at all advanced in life its surface is covered with cicatrices. Frequently one of the fimbriæ of the Fallopian tube adheres to the ovarium.

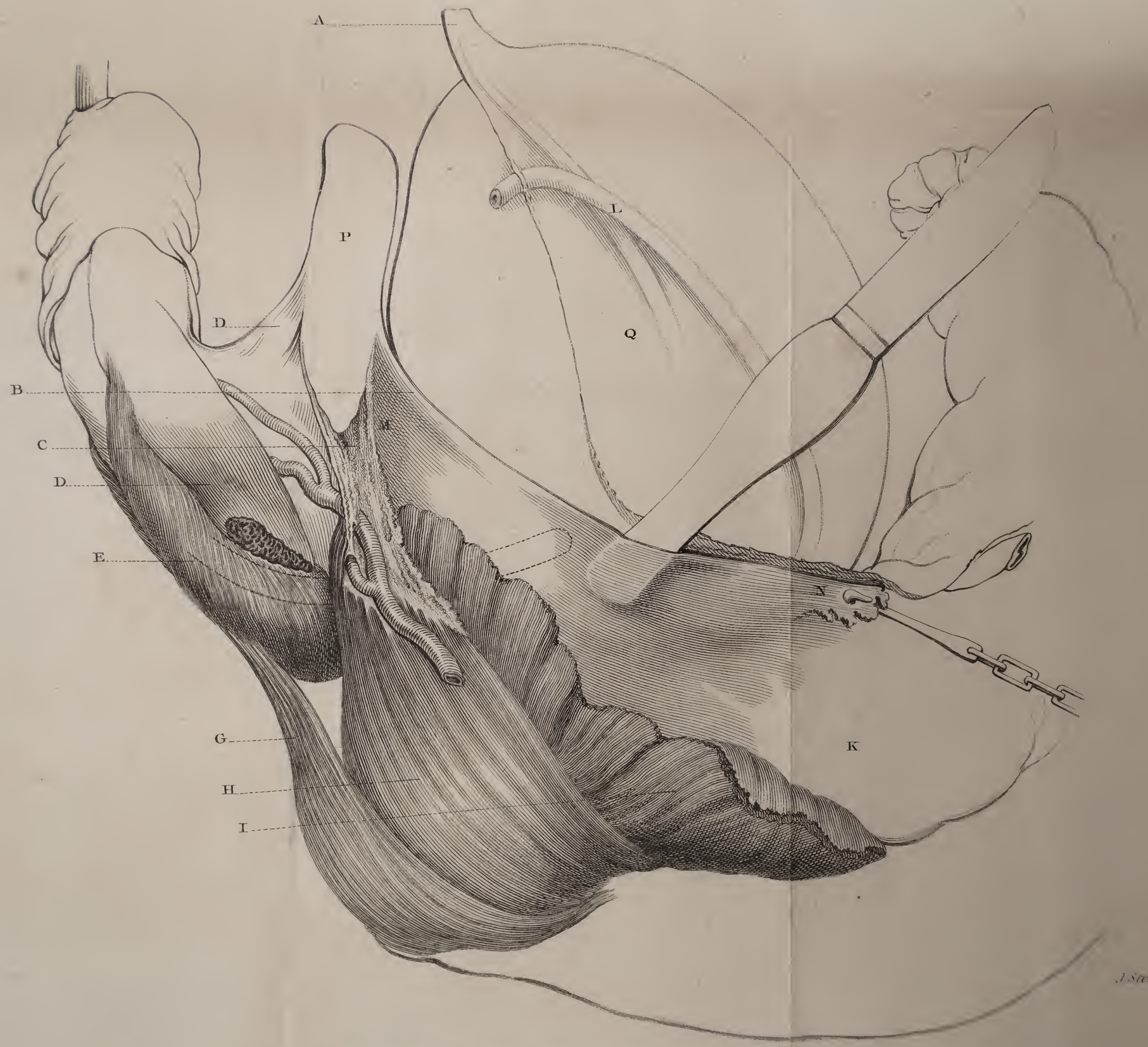
On making a section of the ovarium, it appears to consist of a thick membranous capsule, containing cellular membrane, in which are from fifteen to twenty small oval bodies of different size and appearance: most of these are little capsules from the size of a millet seed to that of a small flattened pea, which contain a serous fluid; they are termed *corpora Graaffiana*. One or more are found to consist of a yellowish granular substance, and constitute what is termed a *corpus luteum*.

On making a longitudinal section of the uterus, its substance is found to be highly vascular, tough, elastic, and fibrous. The body of the uterus contains a triangular cavity, opening at two of its angles into the Fallopian tubes, at the third into the cavity of the cervix uteri, which terminates upon the os tincæ. The cavity of the cervix uteri is narrower at either extremity than just within its orifice. Above and below, slight ridges, which branch towards the body and sides of the uterus, are termed *rugæ palmatæ;* they enclose grooved channels, which lead from the os tincæ inwards.

The *mamma*, or gland which secretes the milk, is only developed between the period of puberty and the age of fifty to fifty-five. Between these ages it consists of a tough white substance, in which more or less adipose substance is involved. The *mammilla*, or nipple, is irregularly traversed by numerous shallow

fissures, and is placed in the centre of a zone of browner skin termed the *areola*, protected by a larger supply of sebaceous follicles.

Upon pressing the gland, milk, or a serous fluid, appears at numerous orifices upon the mammilla: into the larger of these bristles may readily be introduced; and on dissecting off the skin, the bristles are readily shewn to pass along distinct ducts into the substance of the gland, in which they branch. There appears to be no anastomosis between these ducts in the mammilla. The texture of the mammilla is erectile. Each duct, as regards its distribution in the gland, occupies a limited space, and does not communicate at any part with the branches of neighbouring ducts; so that if mercury be injected into a single duct, it distends but one portion of the gland. There seem to be many of these separate elementary portions in the mamma.



H. Mayo, del.t

J. Sawart, scalp.t

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EXPLANATION

OF

PLATE I.

A Section of the Male Pelvis is represented at a stage of the dissection preceding that shewn in the third plate. Directions for preparing this view, may be found, page 92.

A. Reflexion of the Peritoneum from the upper part of the Bladder.

B. The Ligament of the Neck of the Bladder.

C. Section of the Ligament of Camper.

D. The Crus Penis invested by fibres of the Erector Penis.

E. The Bulb of the Urethra, surrounded by the Accelerator Urinæ.

G. The triangular portion of the Sphincter Externus Ani.

H. The outer portion of the Levator Ani.

I. The inner portion of the Levator Ani.

K. The Rectum covered by fascia derived from the Ligamentum cervicis Vesicæ.

L. The Vas Deferens.

M. Fascia connecting the Ligament of the Neck of the Bladder with the Ligament of Camper.

N. Process of Fascia, which extends from the Ligamentum cervicis Vesicæ to the Spinous process of the Ischium.

P. Section of the left Os Pubis.

Q. The Cellular chord, which in the Fœtal state was the Umbilical artery.

PLATE II.

This drawing is intended to represent the exclusive distribution of the Part of that Fifth Nerve, which passes below the Gasserian Ganglion, to Five Muscles.

A. The Pterygoïdeus Externus.

B. The Pterygoïdeus Internus.

C. The Masseter.

D. The Temporal Muscle.

E. The Gasserian ganglion divided: the portion of which belonging to the third division of the Fifth Nerve is represented as everted, so as to expose,

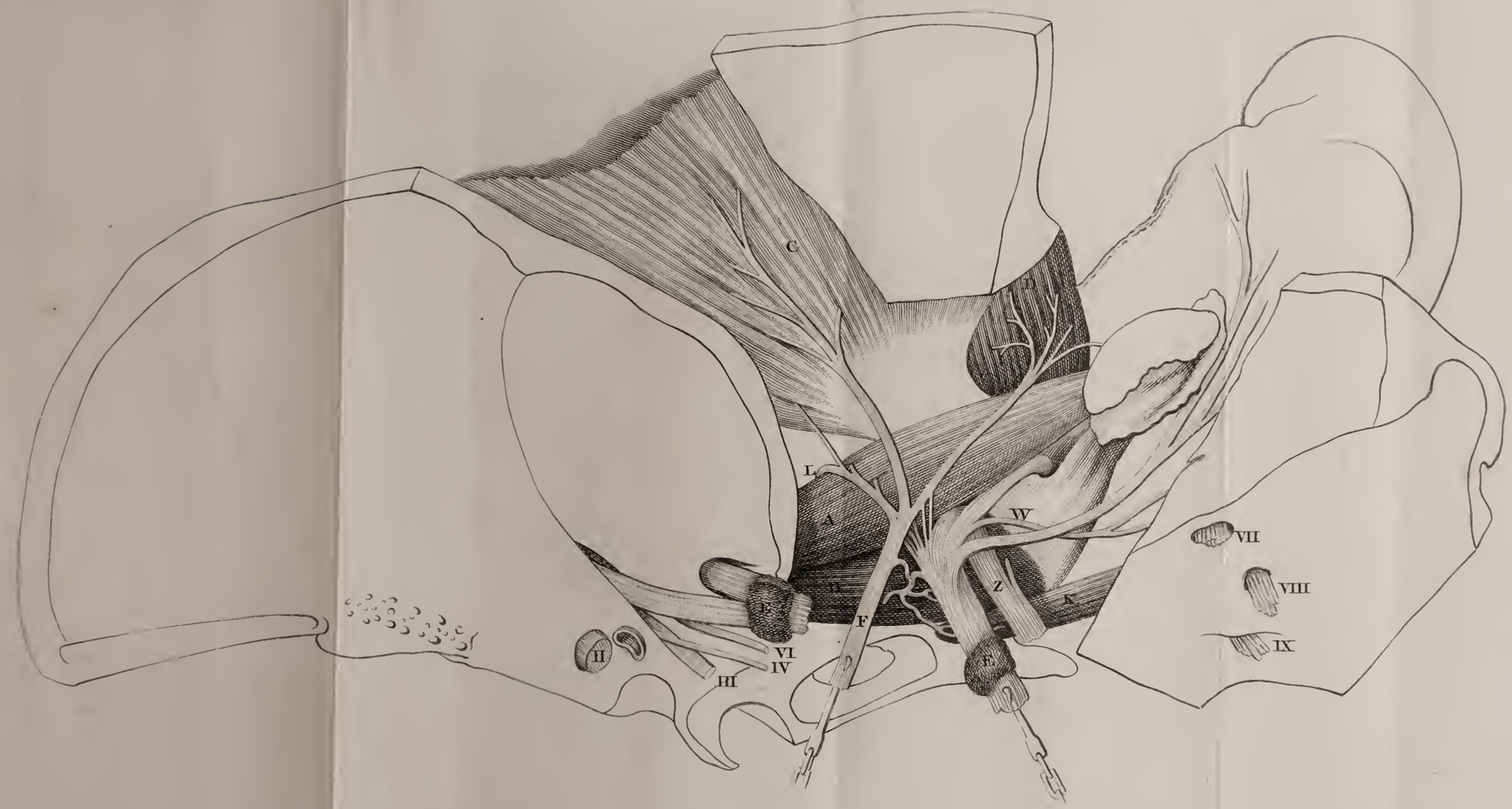
F. The portion of the Fifth Nerve connected with voluntary motion.

K. The circumflexus Palati.

The twigs of nerves which supply the muscles above named, contain filaments from E and F.

L. The Buccinator nerve, which contains a large proportion of filaments derived from the Gasserian ganglion: those, which are derived to it, from F, are entirely consumed upon the temporal and external Pterygoïd Muscles. The continued trunk, distributed to the Buccinator Muscle and Mucous Membrane of the Mouth, is exclusively sentient.

Z. The Gustatory Nerve, divided and reflected, so as to shew the mode in which it is joined by the chorda tympani nerve.



H. Mayo, del.t

J. Stewart, sculp.t

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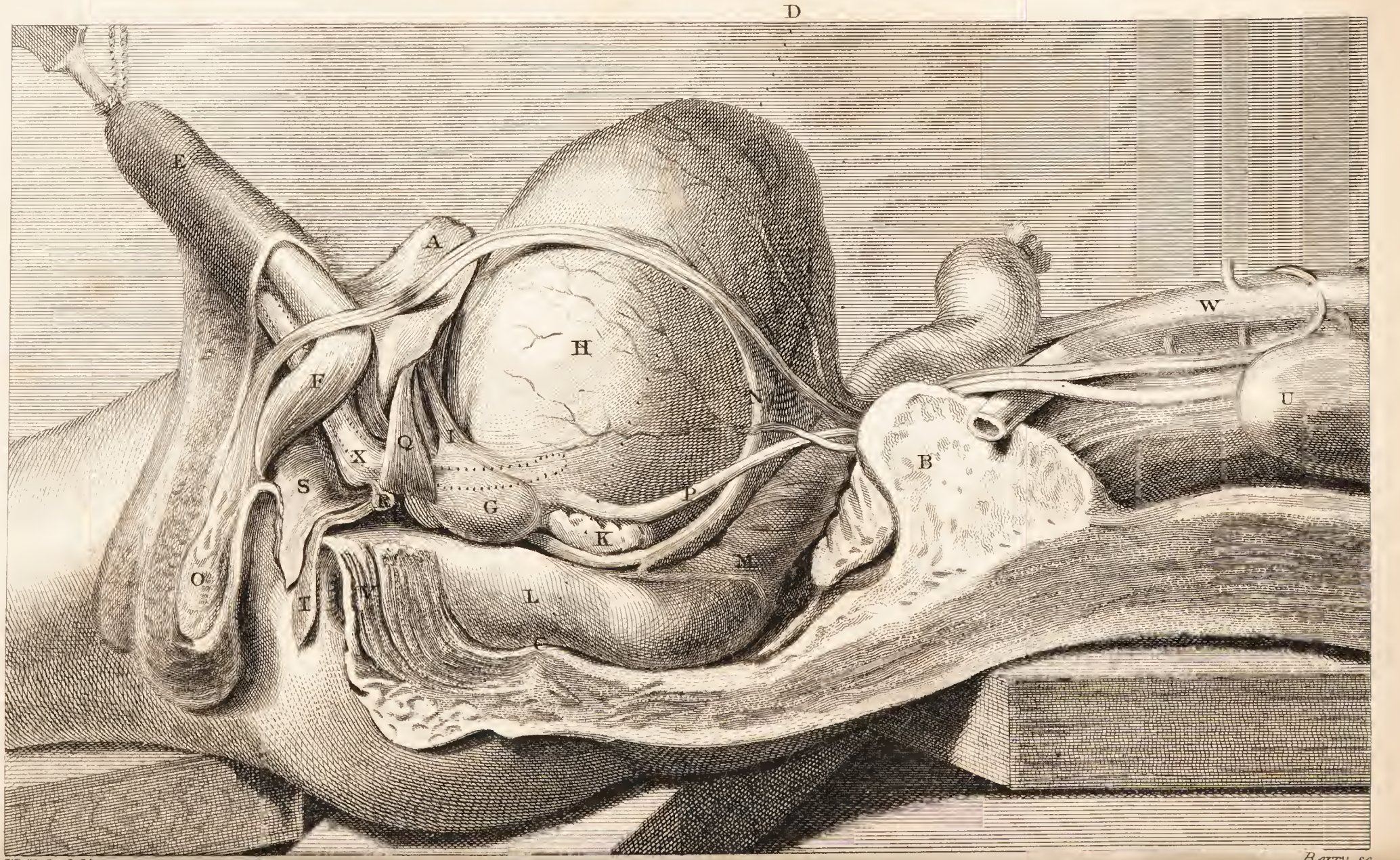
Plate III.



W. Clift, delt.

Berry, sc.

II. The Second Nerve.
III. The Third Nerve.
IV. The Fourth Nerve.
VI. The Sixth Nerve.
VII. The Seventh Nerve.
VIII. The Eighth Nerve.
IX. The Ninth Nerve.

PLATE III.

A Side View of the Pelvis.

A. The Symphysis of the Pubes.
B. The Os Sacrum, where it forms the Joint with the Os Ilii.
C. The Apex of the Os Coccygis.
D. A dotted Line drawn through the Axis of the Cavity of the Pelvis, showing the Obliquity of the Cavity in the erect Position of the Body, the line in such position approaching nearer to a horizontal than a perpendicular direction.
E. The Penis, having a Staff introduced along the Urethra to the Bladder.
F. The left Crus of the Penis, detached from the left Ilium and Pubes, and turned to one Side.
G. The Prostate Gland; the dotted Lines marking the Course of the Urethra through it.
H. The Bladder, partially distended.
I. The Ligamentum inferius Vesicæ, or tendinous Attachment of the Bladder to the Pubes.

K. The left Vesicula seminalis.

L. The Rectum.

M. The Peritonæum: the Reflexion of that Membrane from the Bladder to the Rectum is seen.

N. The left Vas deferens.

O. The Testicle in the Scrotum.

P. The Ureter.

Q. The Compressores Urethræ Muscles surrounding and attaching the membranous Portion of the Urethra to the Symphysis of the Pubes. The introduction of the staff has thrown these muscles on the stretch.

R. Cowper's Glands.

S. The Accelerator Urinæ Muscle detached from the Bulb of the Urethra.

T. The transversalis Perinæi Muscle detached from the Ischium.

V. The Sphincter Ani Muscle, and Part of the Levator Ani.

U. The left Kidney.

W. The Aorta.

X. The Bulb of the Urethra. The dotted lines continued through the membranous portion of the urethra and prostate gland mark the passage of the staff.

THE END.

S. Gosnell, Printer, Little Queen Street, London.